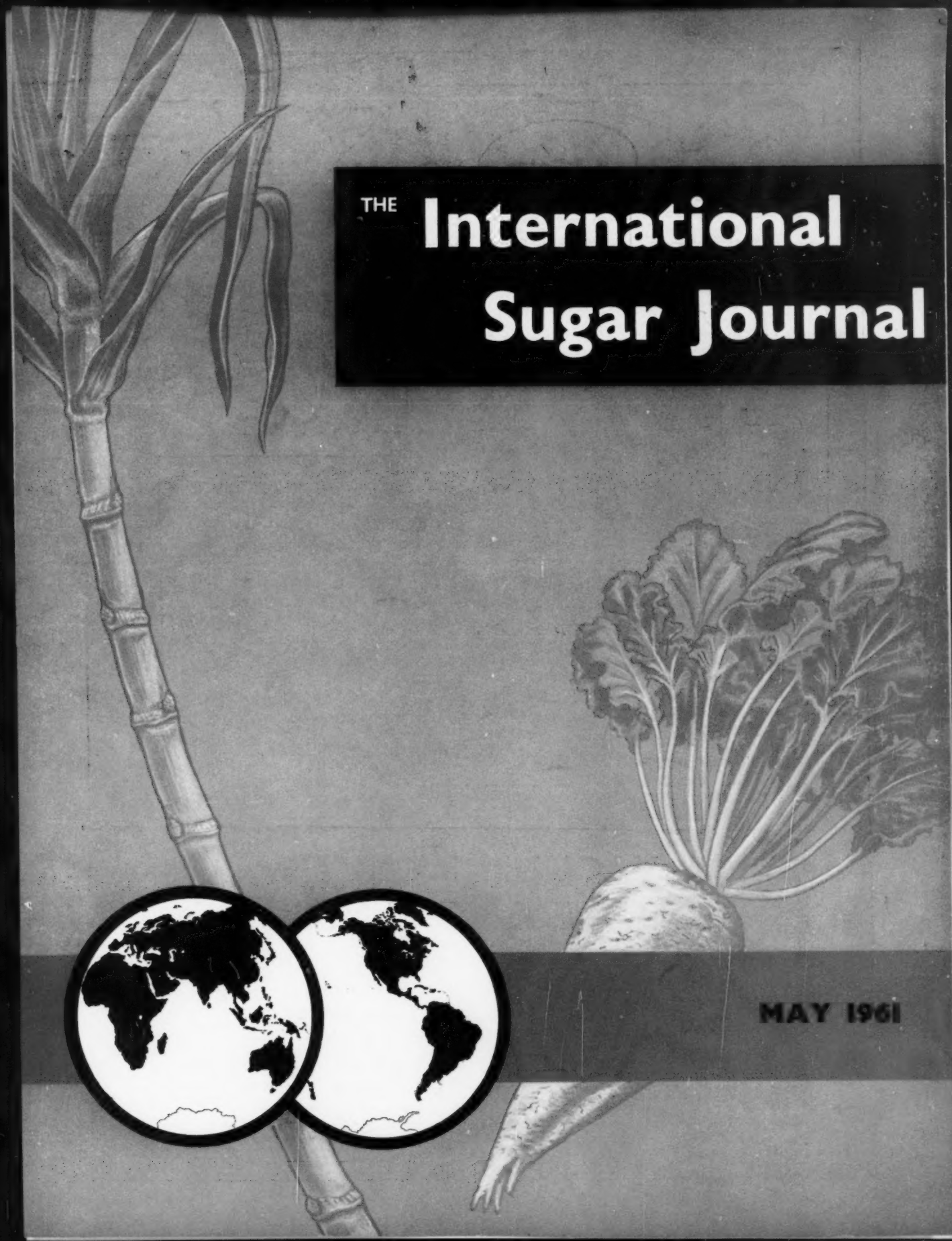

THE International Sugar Journal
MAY 1961

A Low Head Vacuum Pan in our works prior to dispatch. The Hydraulic valve and pipe arrangement can be clearly seen.

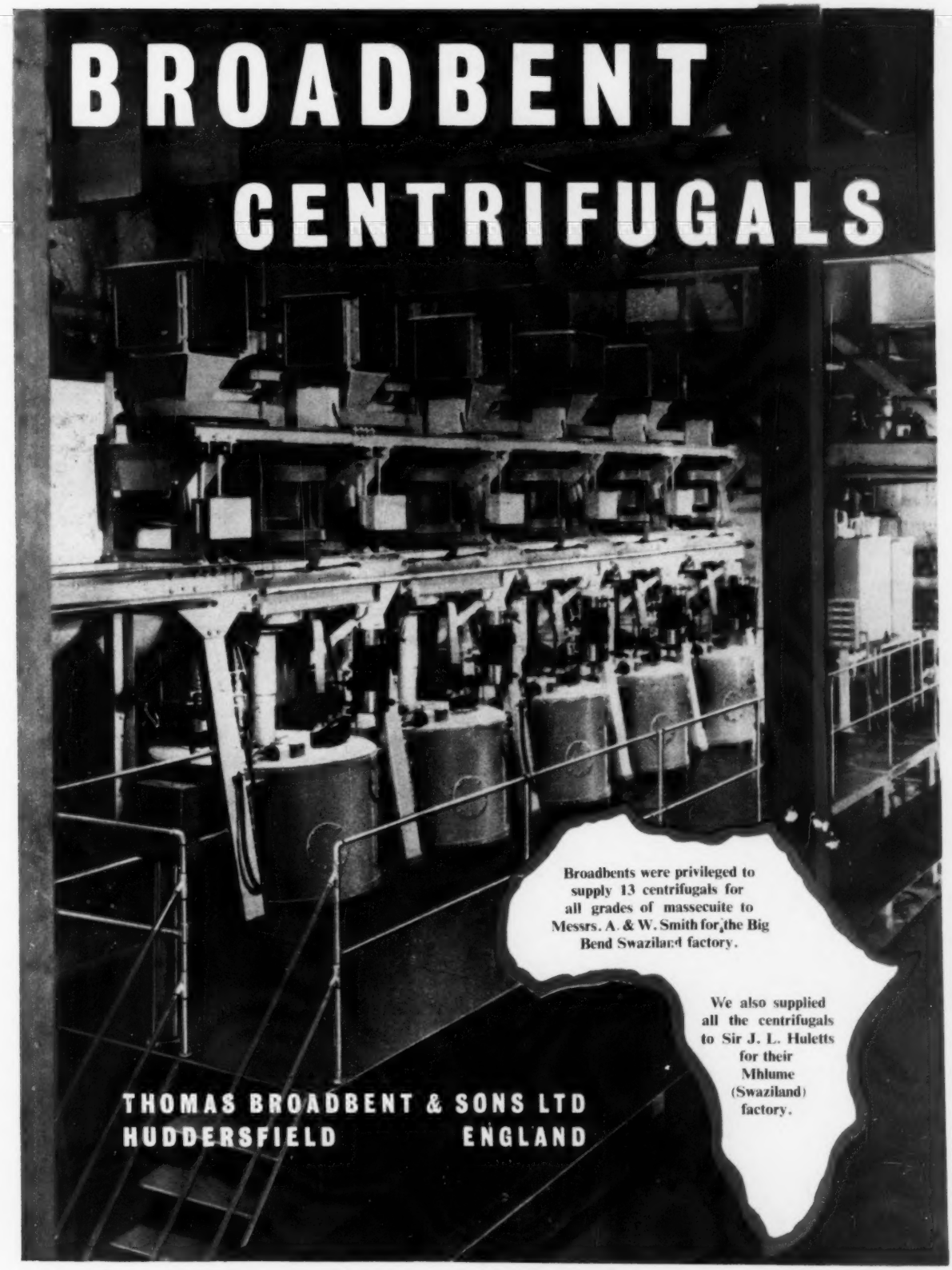
Mirrlees'

VACUUM PANS
with Hydraulic Valve Operation

MIRRLEES VACUUM PANS GIVE EVEN DISTRIBUTION OF STEAM, GOOD DRAINAGE, AND EFFICIENT ENTRAINMENT PREVENTION. THEY ARE MANUFACTURED IN STREAM FLOW, LOW HEAD OR DUPLEX TYPES.

THE MIRRLEES WATSON COMPANY LIMITED

HEAD OFFICE AND WORKS: 45 NORTHLAND STREET, GLASGOW SCOTLAND — CABLES: "MIRRLEES GLASGOW"
LONDON OFFICE: 30 GROSVENOR GARDENS, S.W.1. — CABLES: "MIRRLEES SOWEST LONDON"

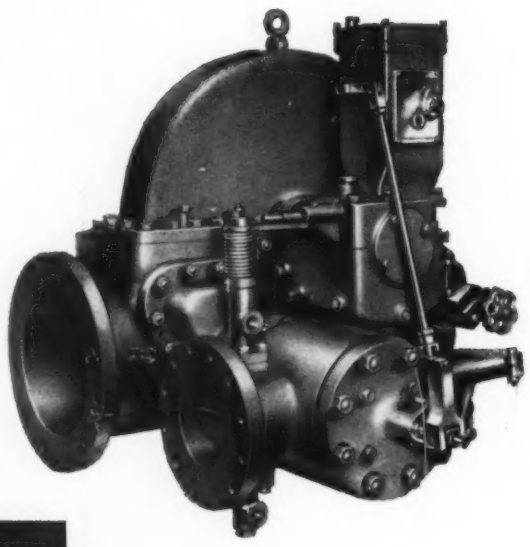

BROADBENT
CENTRIFUGALS
Broadbents were privileged to supply 13 centrifugals for all grades of massecuite to Messrs. A. & W. Smith for the Big Bend Swaziland factory.
We also supplied all the centrifugals to Sir J. L. Huletts for their Mhlume (Swaziland) factory.
THOMAS BROADBENT & SONS LTD
HUDDERSFIELD ENGLAND

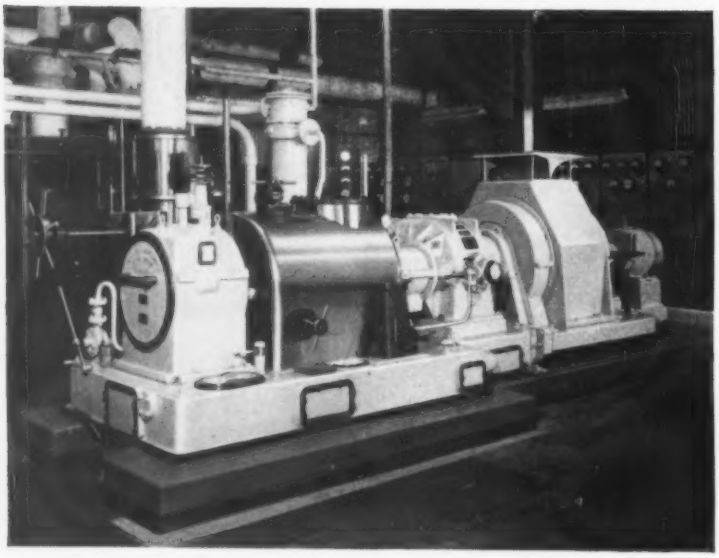
THE B & M SINGLE STAGE
SUGAR MILL TURBINE

Simple in design
Reliable and Economical
in Operation

25 to 1,200 h.p. direct coupled at speeds of up to 5,000 r.p.m. max. or supplied with reduction gearing of any desired ratio.

'B & M' single stage variable speed mechanical drive turbine, particularly adapted for SUGAR MILLS, PUMPS, etc.





750 kw back pressure turbine installed at Farleigh Sugar Mill, Queensland.

1,500 kw 'B & M' back pressure turbine and several steam engines also installed.

Many hundreds of 'B & M' Steam Turbines and Steam Engines have been supplied to the Sugar Industry for electrical and mechanical drives for:

CRUSHERS
MILLS
CANE KNIVES
PUMPS ETC.

Also **VACUUM PUMPS** Reciprocating and Rotary types.
'ARCA' Pressure and Temperature REGULATORS

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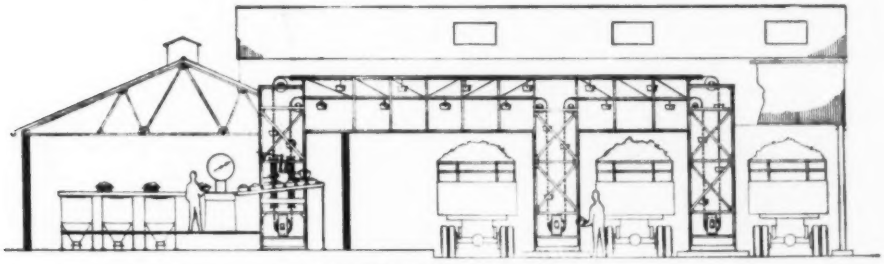
BIRMINGHAM 16 · ENGLAND

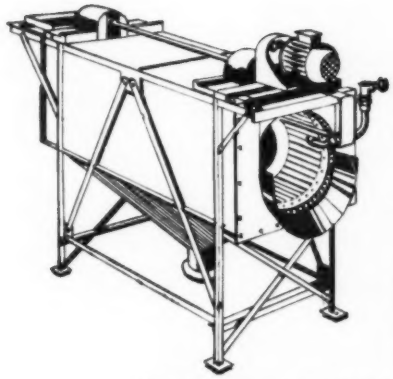
TAREHOUSE EQUIPMENT

AS SUPPLIED TO THE BRITISH & EIRE SUGAR CORPORATIONS AND TO MANY OF THE SUGAR BEET SEED GROWERS



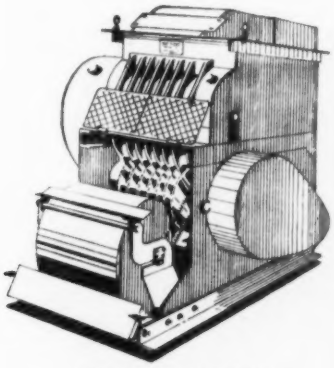
SAMPLES CONVEYOR

Combining regulated feed of samples direct from lorry, and safety by elimination of road crossing by the operators



SPRAY WASHER

Using water at 90 lb. p.s.i. ensures clean roots 20 samples each of 50 lbs. handled per hour. Speed of drum easily variable between 3 and 22 r.p.m. to suit type and quantity of dirt adhering to sample roots.

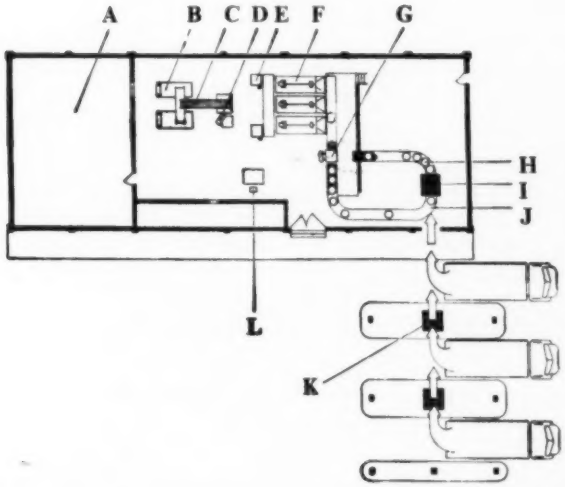


MULTIPLE SAW

Takes up to 100 lbs. of roots, handling a 30 lb. sample in 25 secs. and producing a representative sample of brei.

A TAREHOUSE LAYOUT

– handling 650 samples per day.



A *Laboratory*
B *Multiple Saw*
C *Elevator*
D *Scales (Clean)*
E *Topping Tables*
F *Spray Washer*
G *Scales (Dirty)*
H *Empty Pannikins*
I *Unloading Leg of Samples Conveyor*
J *Full Pannikins*
K *Loading Leg of Samples Conveyor*
L *Recorder*

COCKSEDGE & Co. LTD

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The 'Super' Universal Sack Closing Machine

MODEL NO. 5B

Fitted with 10 or 12 ft. Conveyor and Special Clutch Drive

This machine is fitted with a conveyor 10 or 12 ft. overall and a Special Clutch Drive which allows the conveyor to be run independently of the sewing head.

Jute, Hessian, Paper Lined Hessian, Cotton and Paper Sacks weighing from 50 to 325 lbs. can be sewn on this machine.

Machines can be seen working by appointment.

Power required 2 h.p. *Shipping weight : 14 cwts.*

Manufactured in Great Britain by :

The Sack Filling & Sewing Machine Syndicate Limited

(Timewell's Patent)

TIMEWELL WORKS · LOCKFIELD AVENUE · BRIMSDOWN · ENFIELD . MIDDX.

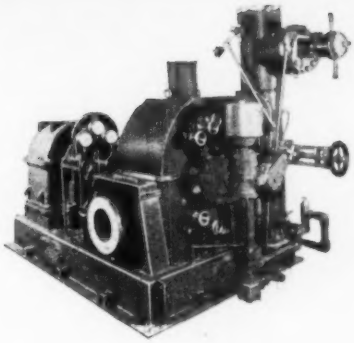
Telephone : HOWARD 1188 *Telegrams :* FECIT, ENFIELD

Mirrlees' STEAM TURBINES for the Sugar Factory

MIRRLEES STEAM TURBINES COVER A WIDE RANGE OF APPLICATIONS IN THE SUGAR FACTORY

FROM

CANE KNIVES DRIVE

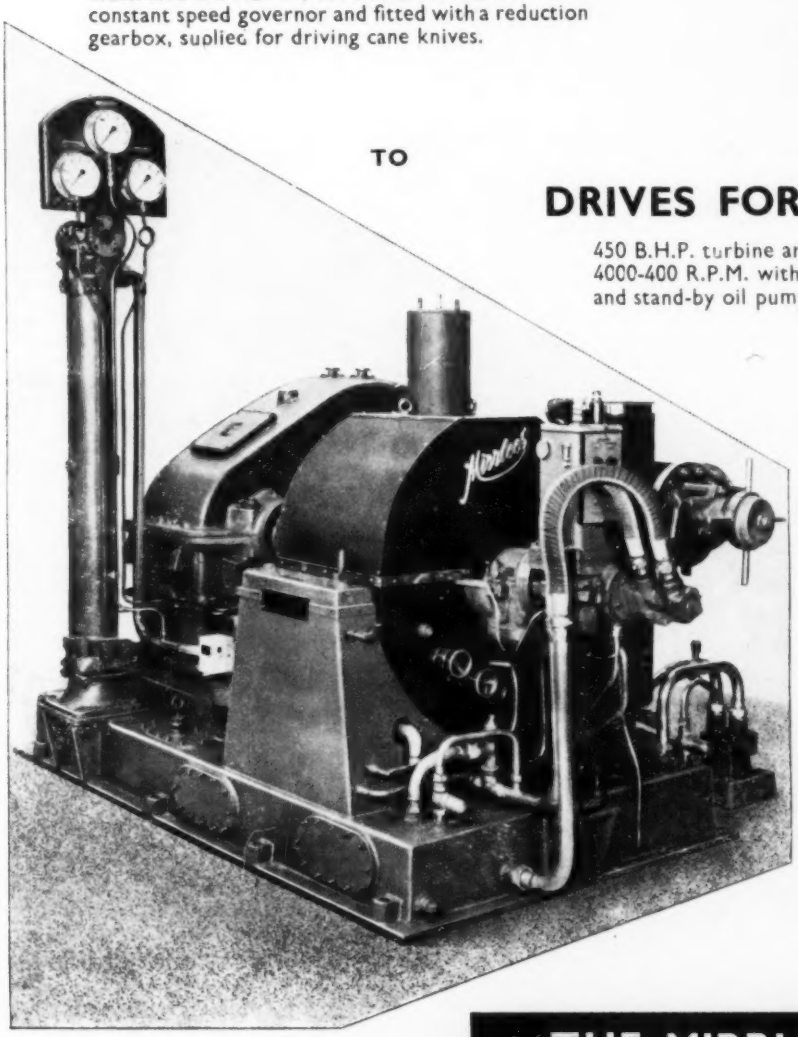


Illustrated is a F.E.A.7, 350-400 B.H.P. turbine with constant speed governor and fitted with a reduction gearbox, supplied for driving cane knives.

TO

DRIVES FOR SUGAR MILLS

450 B.H.P. turbine and single reduction gear box 4000-400 R.P.M. with variable speed governor and stand-by oil pump.



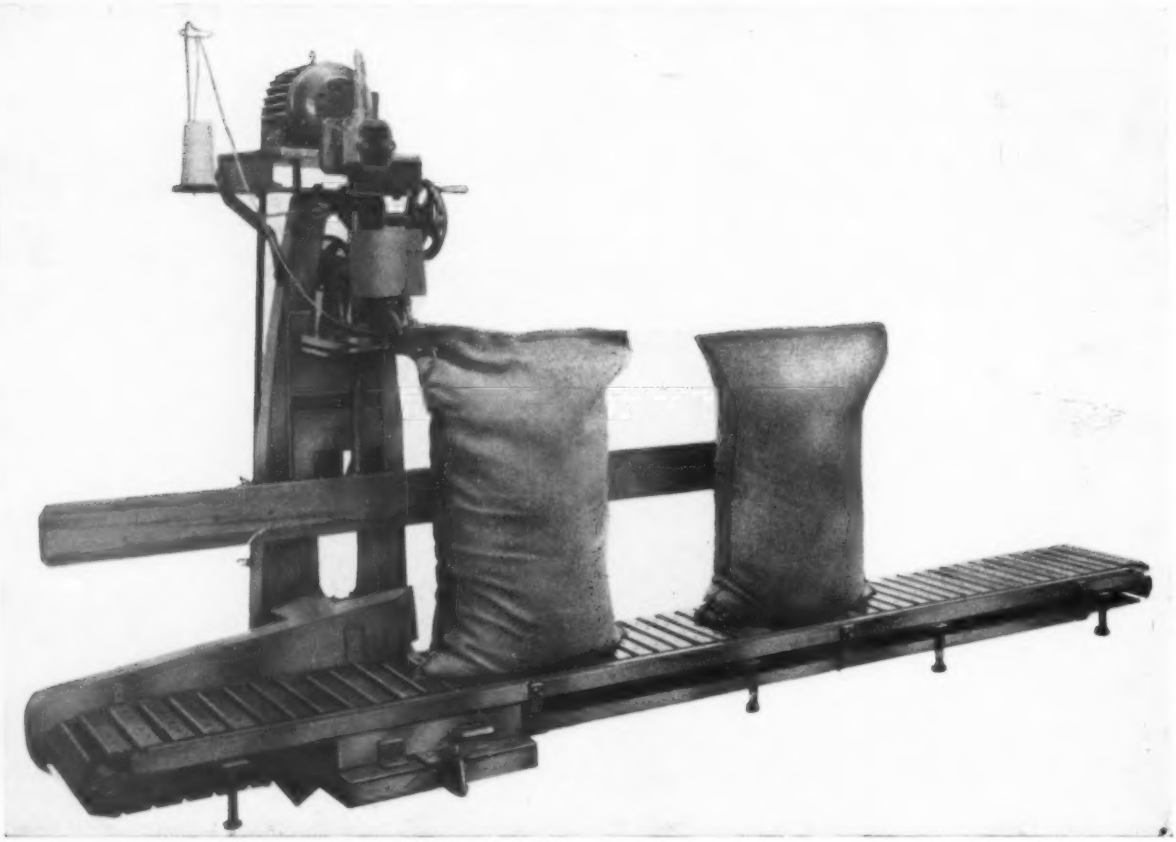
MAY ALSO BE USED AS A LOW COST REPLACEMENT FOR EXISTING PRIME MOVERS WHERE INCREASED MILLING CAPACITY IS REQUIRED

THE MIRRLEES WATSON COMPANY LIMITED
GLASGOW SCOTLAND

The 'Super' Universal Sack Closing Machine

MODEL NO. 5B

Fitted with 10 or 12 ft. Conveyor and Special Clutch Drive



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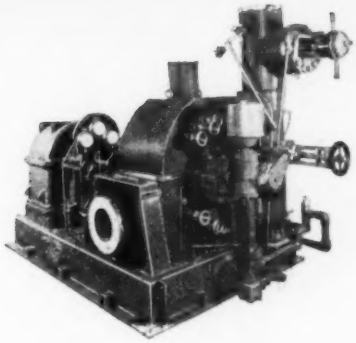
FROM

CANE KNIVES DRIVE



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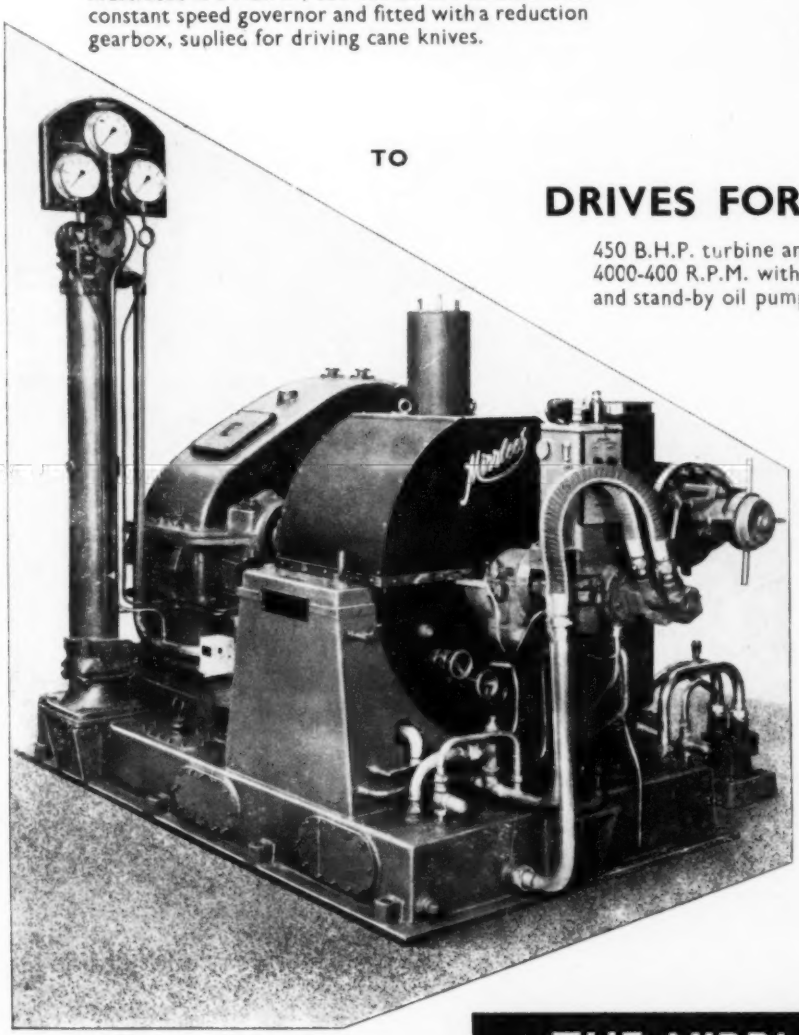

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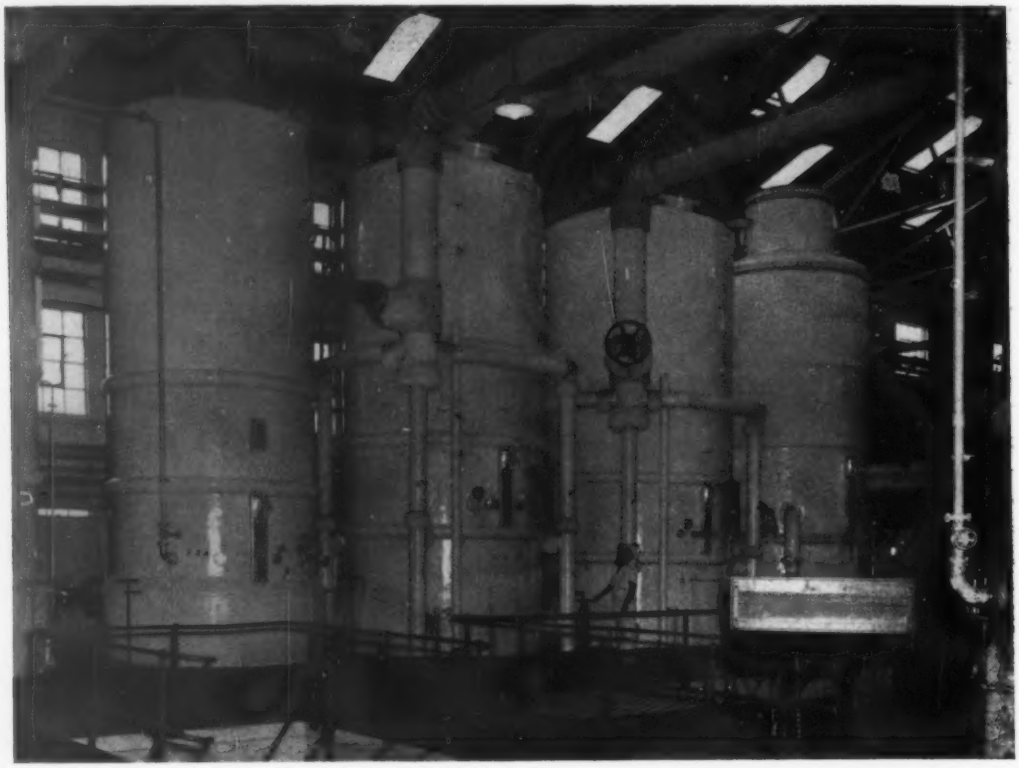
THE MIRRLEES WATSON COMPANY LIMITED
GLASGOW SCOTLAND



Evaporators at the British Sugar Corporation Beet Sugar Factory at Cupar fitted with H & W 70/30 Brass Tubes. The evaporators are lagged with plastic lagging. (Photograph by courtesy of the British Sugar Corporation Limited).

H&W

BRASS TUBES

for

JUICE HEATERS

EVAPORATORS

VACUUM PANS

for quality uniformity and dependability

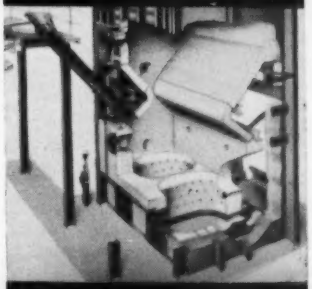
HUDSON & WRIGHT LTD. HALBERTON STREET, BIRMINGHAM 18

50, WELLINGTON STREET, GLASGOW, C.2.

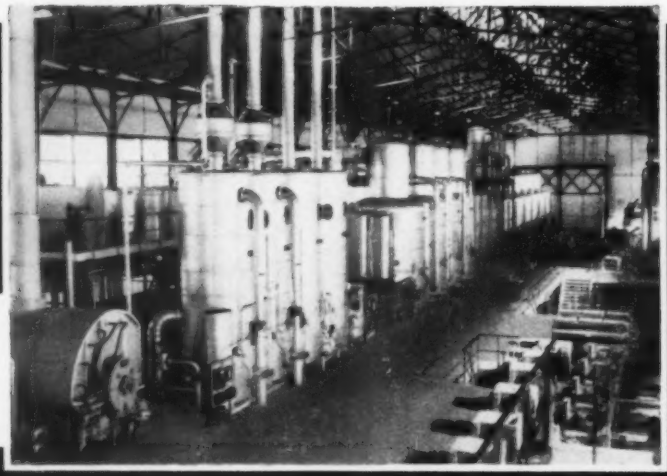
POWER PLANTS:

Back-pressure turbines. The high speeds are reduced by means of a fully reliable, smoothly running reduction gear of up-to-date design.

Bagasse furnaces: this twin-hearth Ward furnace for instance, built of ordinary refractory brick and with arches and front wall constructed of specially shaped refractory bricks carried on steel supports.



For all sugar machinery apply to STORK - Hengelo - Holland.

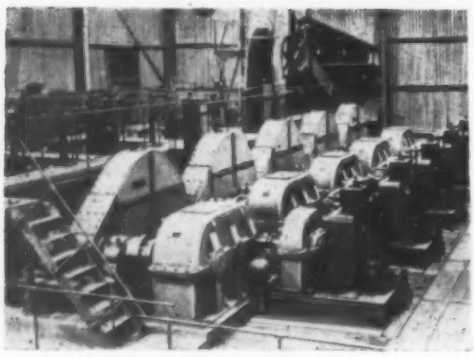


WE

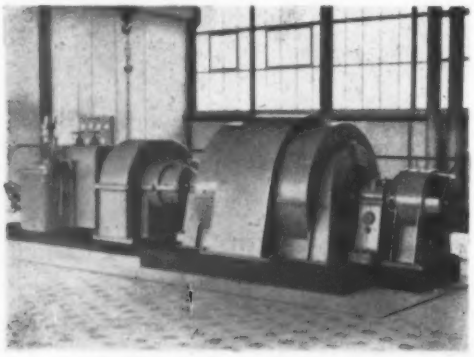
can supply everything for your cane or beet

SUGAR FACTORY

Set of five 26" x 36" mills.
Urena sugar factory (Venezuela)



1800 kW turbo-alternator.
Melatya sugar factory (Turkey)



BUILDINGS
- Steel structures

PROCESSING MACHINERY
- RT and DdS continuous diffusers
- Cane mills
- Liming and sulphitation units
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- Vacuum pans
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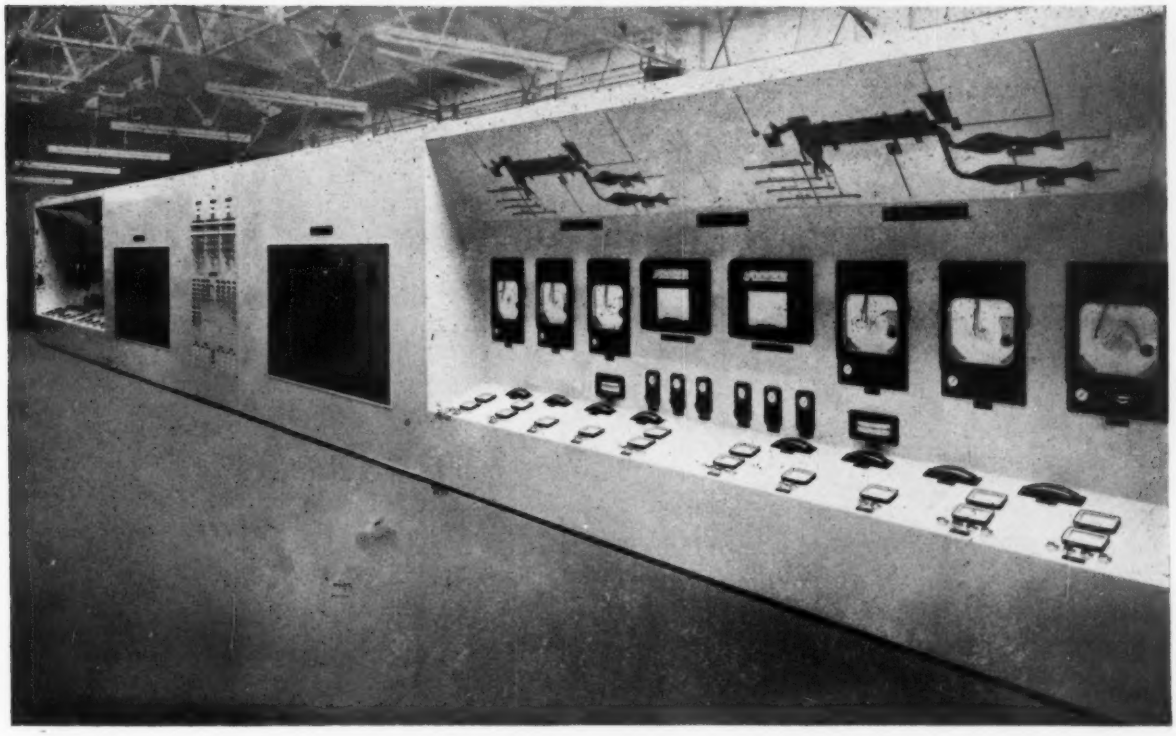
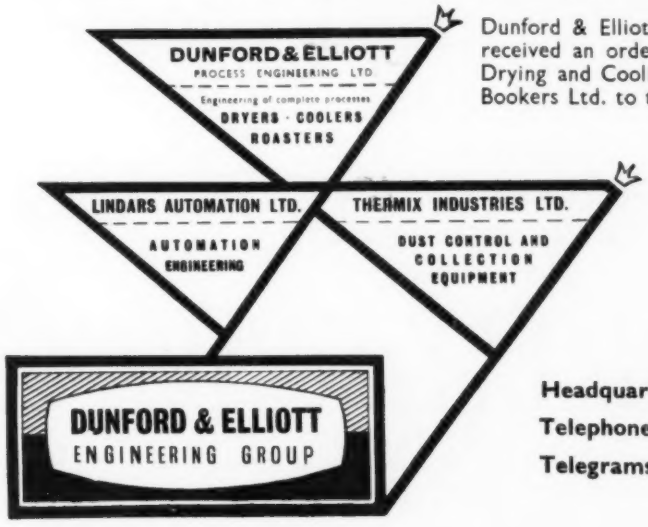
TATE & LYLE
Choose ROTARY LOUVRE

One of Dunford & Elliott's latest and largest achievements for sugar refineries is the installation of four completely automatic Rotary Louvre Dryers and ancillary equipment at the THAMES REFINERY of TATE & LYLE LTD.—believed to be the biggest refinery in the world.



Control panel for Rotary Louvre sugar drying installation at the new Tate & Lyle Thames Refinery, designed and supplied by Dunford & Elliott. Photo by courtesy of Tate & Lyle Ltd.



Dunford & Elliott are also proud to announce having received an order to supply *Rotary Louvre* Sugar Drying and Cooling installations through Messrs. Vickers & Bookers Ltd. to two factories in the U.S.S.R.

Rotary Louvre Dryers and Coolers are used in leading industries throughout the world—as well as in the sugar industry—and frequently form part of such giant industrial projects as *Durgapur* in India.

Headquarters: 143 Maple Road, Surbiton, Surrey
Telephone: Kingston 7799
Telegrams: Lindaresco, Telex, London.

JUST ONE!

Under a single comprehensive contract, with undivided responsibility, 'ENGLISH ELECTRIC' undertake complete factory electrification.

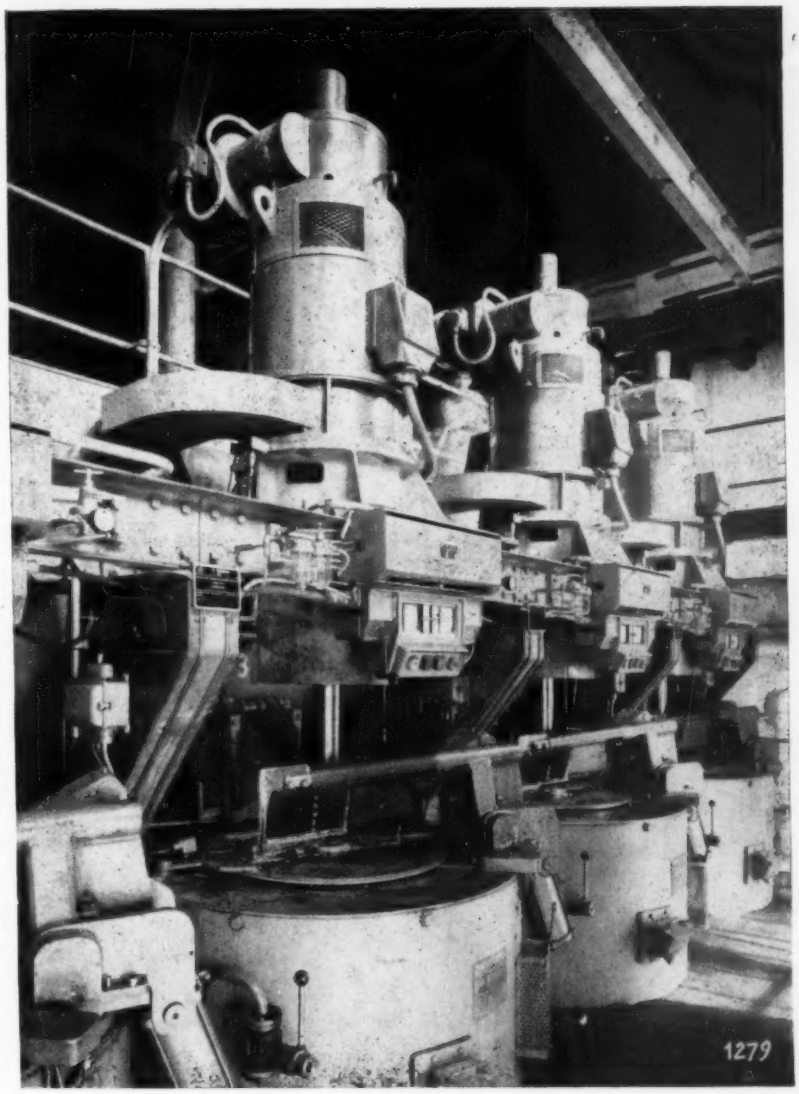
DIESEL ALTERNATOR SETS
STEAM TURBO ALTERNATOR SETS
TRANSFORMERS · SWITCHGEAR
FUSEGEAR · CONTROL GEAR · MOTORS

'ENGLISH ELECTRIC'

THE ENGLISH ELECTRIC COMPANY LIMITED, ENGLISH ELECTRIC HOUSE, STRAND, LONDON, W.C.2
Electrical Plant Division, Stafford
WORKS: STAFFORD · PRESTON · RUGBY · BRADFORD · LIVERPOOL · ACCRINGTON

Since it was established in 1890, our Company has manufactured machinery for the sugar industry, and for more than forty years has specialized in constructing centrifugals.

Our Technical Service is continually developing machines which incorporate improvements designed to meet the technological requirements of new and varying processes in the sugar industry, taking into account the demands of the European Common Market. These new centrifugals are distinguished for their high grade of *standardization* and for their low cost both from the point of view of the purchase price and running costs.



FULLY AUTOMATIC SUGAR CENTRIFUGALS

Type	*Basket D × H*	*Basket cross section*	*Massecuite Max. Charge*	*Performances*		
				Mod.	*Max. sp. r.p.m.*	*Cycles per hr.*
"SCARA. U"	1250 × 830 mm.	Cylindrical with truncated cone shaped bottom	500 kg.	Normal	1000	30
				Velox	1500	25
"SCAME. P"	1050 × 585 mm.	Cylindrical with flat bottom	350 kg	Normal	1500	20
				Velox	1800	10
"SCAME. G"	1220 × 762 mm.	Cylindrical with flat bottom	650 kg.	Normal	1000	25
				Velox	1500	20

BOSCO TERNI

Officine Meccaniche e Fonderie

A. BOSCO

TERNI **ITALY**

COMPLETE ALCOHOL PLANTS *by APV*

APV have been responsible for the development, design, construction and commissioning of complete alcohol plants all over the world. They have the experience, resources and organisation to deal with complete projects for the production of all types of alcohol from molasses, as well as from dates, rice, grain and other raw materials.

Alcohol projects undertaken by APV in recent years include the following:—

EAST INDIA DISTILLERIES LTD., INDIA.
900,000 galls./year of rectified spirit from molasses.

BURMA PHARMACEUTICAL INDUSTRY, BURMA.
750,000 galls./year of alcohol and 330,000 lb./year of dried medicinal yeast from rice.

COLONIAL SUGAR RECTIFYING CO., AUSTRALIA.
2,100,000 galls./year of absolute alcohol or rectified spirit.

MODERN CHEMICAL INDUSTRIES LTD., IRAQ.
360,000 galls./year of rectified spirit from dates.

SUGAR MANUFACTURERS' ASSOCIATION, JAMAICA
2,100,000 galls./year of absolute alcohol from rum.

MACNAB DISTILLERIES LTD., SCOTLAND.
360,000 galls./year of grain whisky.

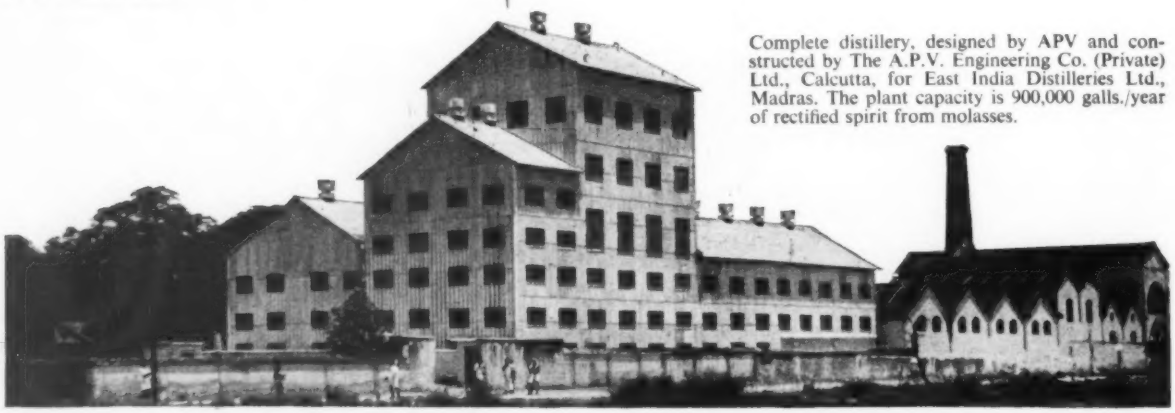
PREMIER SUGAR MILLS, PAKISTAN.
Fermentation plant for 600,000 galls./year distillery.

DYER-NEAKIN LTD., INDIA.
360,000 galls./year of high quality potable rectified spirit from molasses.

WRAY & NEPHEW LTD., JAMAICA.
180,000 galls./year of gin spirit from molasses.

S. A. DAVSON & CO. LTD., BRITISH GUIANA.
360,000 galls./year of rum from molasses wash.

BEN NEVIS DISTILLERY LTD., SCOTLAND.
180,000 galls./year of grain whisky.



Complete distillery, designed by APV and constructed by The A.P.V. Engineering Co. (Private) Ltd., Calcutta, for East India Distilleries Ltd., Madras. The plant capacity is 900,000 galls./year of rectified spirit from molasses.

APV **CHEMICAL ENGINEERING DIVISION**

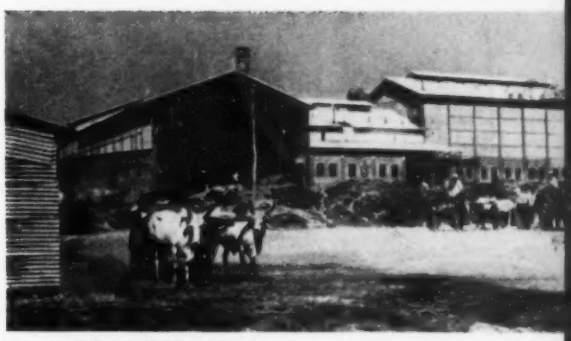
Contractors and engineers to the fermentation and alcohol distillation industries. Plants for grain cooking, saccharification, yeast culture, fermentation, CO_2 recovery, etc. Stills and other equipment for the manufacture of all types of alcohol including whisky, gin and rum.

THE A.P.V. COMPANY LIMITED · MANOR ROYAL · CRAWLEY · SUSSEX

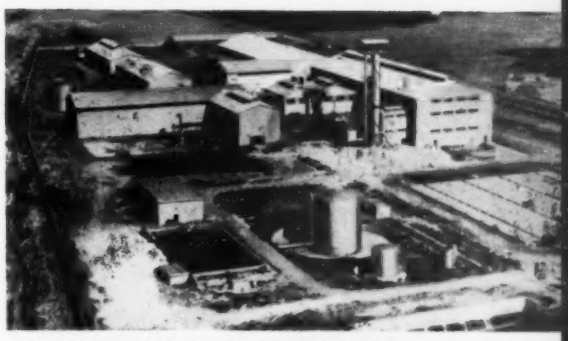
TELEPHONE: CRAWLEY 1360. TELEX: 8737. TELEGRAMS: ANACLASTIC, CRAWLEY

Objective Consulting and Conscientious supervision of execution of projects all along the line of SUGAR will improve

PERFORMANCE
ECONOMY
EFFICIENCY



CANE SUGAR PLANT INDIA

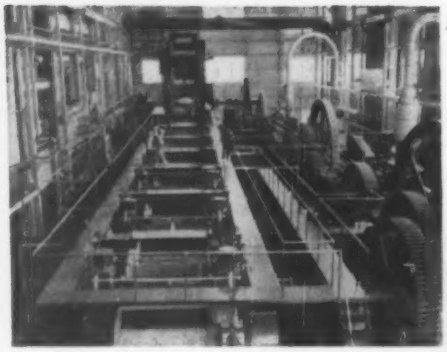


BEET SUGAR PLANT AND REFINERY IRAQ

BEET SUGAR PLANT AND REFINERY IRAN

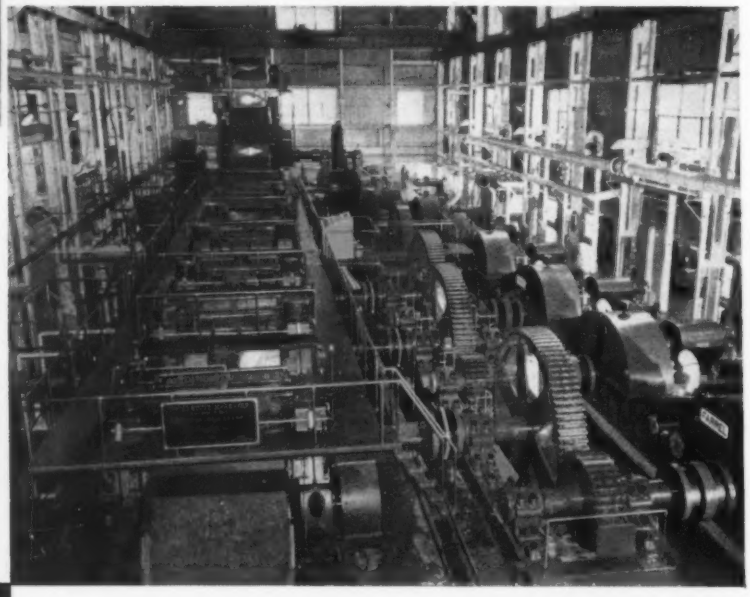
SALZGITTER INDUSTRIEBAU GMBH

SALZGITTER-DRÜTTE



Photos show a sugar mill before and after conversion by Farrel to turbine drive.

Put this experience to work



133

turbine drives since 1950

COUNTRY OR STATE	NUMBER
LOUISIANA	13
COLOMBIA	6
PUERTO RICO	24
VENEZUELA	8
CUBA	24
BRAZIL	1
MEXICO	11
JAMAICA	4
DOMINICAN REPUBLIC	13
FLORIDA	11
ARGENTINA	10
PHILIPPINE ISLANDS	6
PANAMA	2

...on your drive conversion

During the last ten years, Farrel has designed and built 133 mill turbine drives for factories in many areas of the sugar belt (see list). Ranging in turbine horsepower from 250 to 3600, these were for both new installations and conversion of existing engine drives.

Drawing on this experience Farrel has many suggestions for modernizing the drive section of your tandem, each designed to increase milling capacity and efficiency. Farrel engineers are qualified to recommend a suitable conversion plan to meet individual operating conditions. When possible, existing gearing is examined to determine its adequacy for operation at higher speeds under increased power.

Put Farrel's proved ability to work for you when you convert to turbine drive. In the meantime, send for a copy of bulletin 312.

FARREL-BIRMINGHAM COMPANY, INC.
ANSONIA, CONNECTICUT, U.S.A.

Plants: Ansonia and Derby, Conn., Buffalo and Rochester, N. Y.

FARREL

FB-1215

These are our strong points –

- 20% more bearing area
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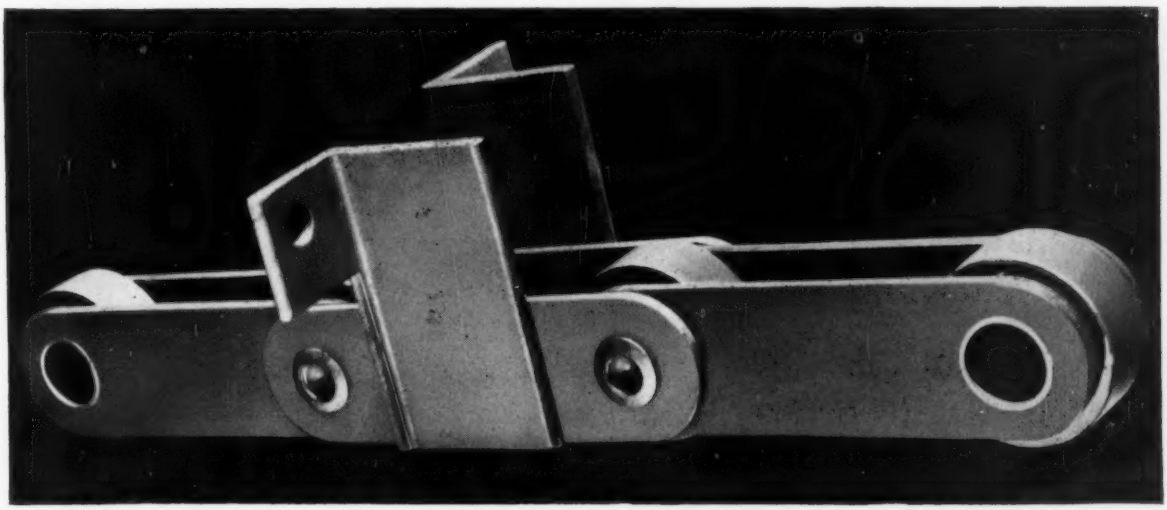

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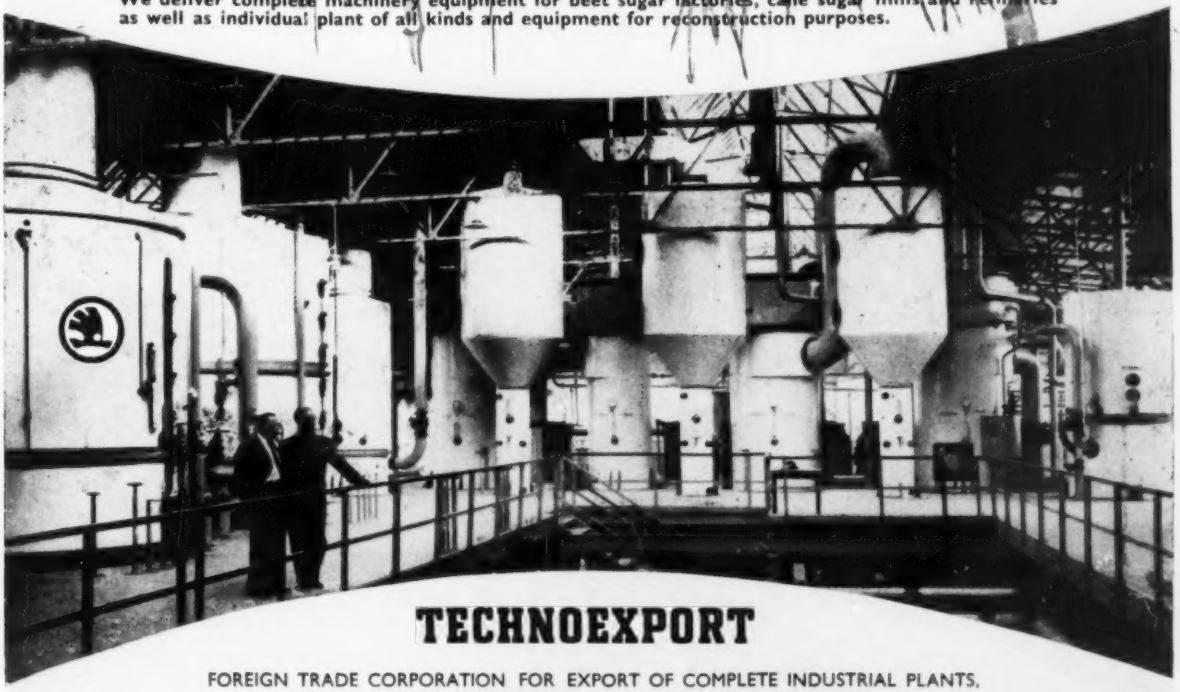

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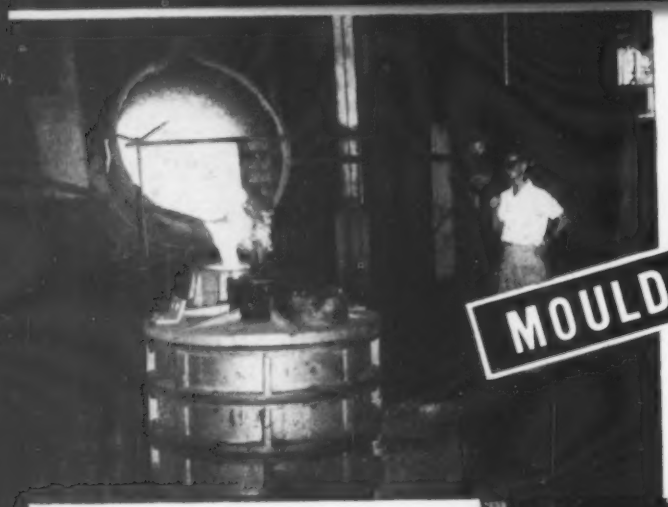

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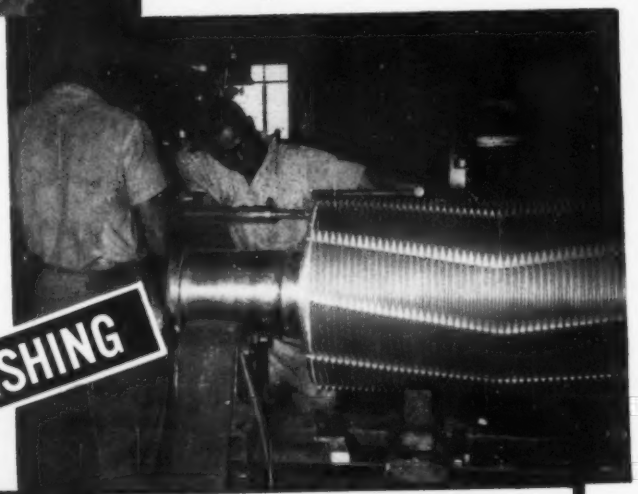

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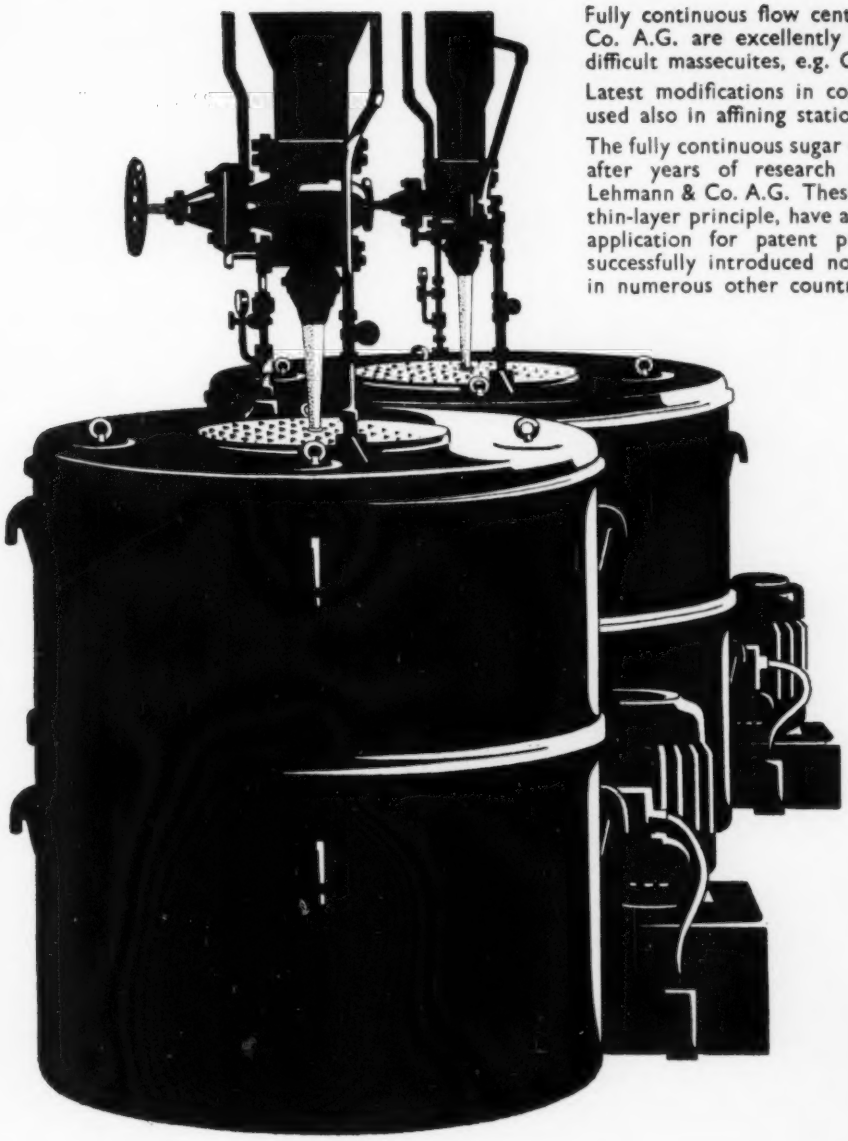

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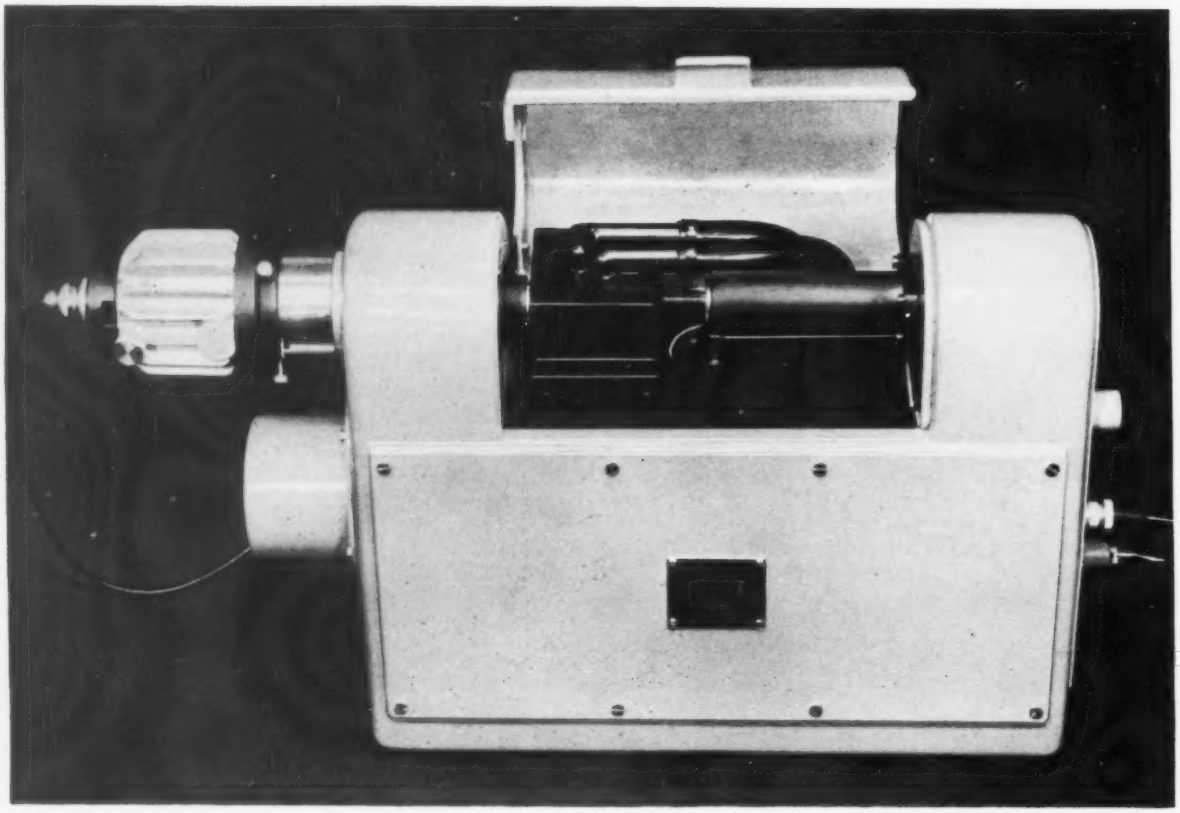

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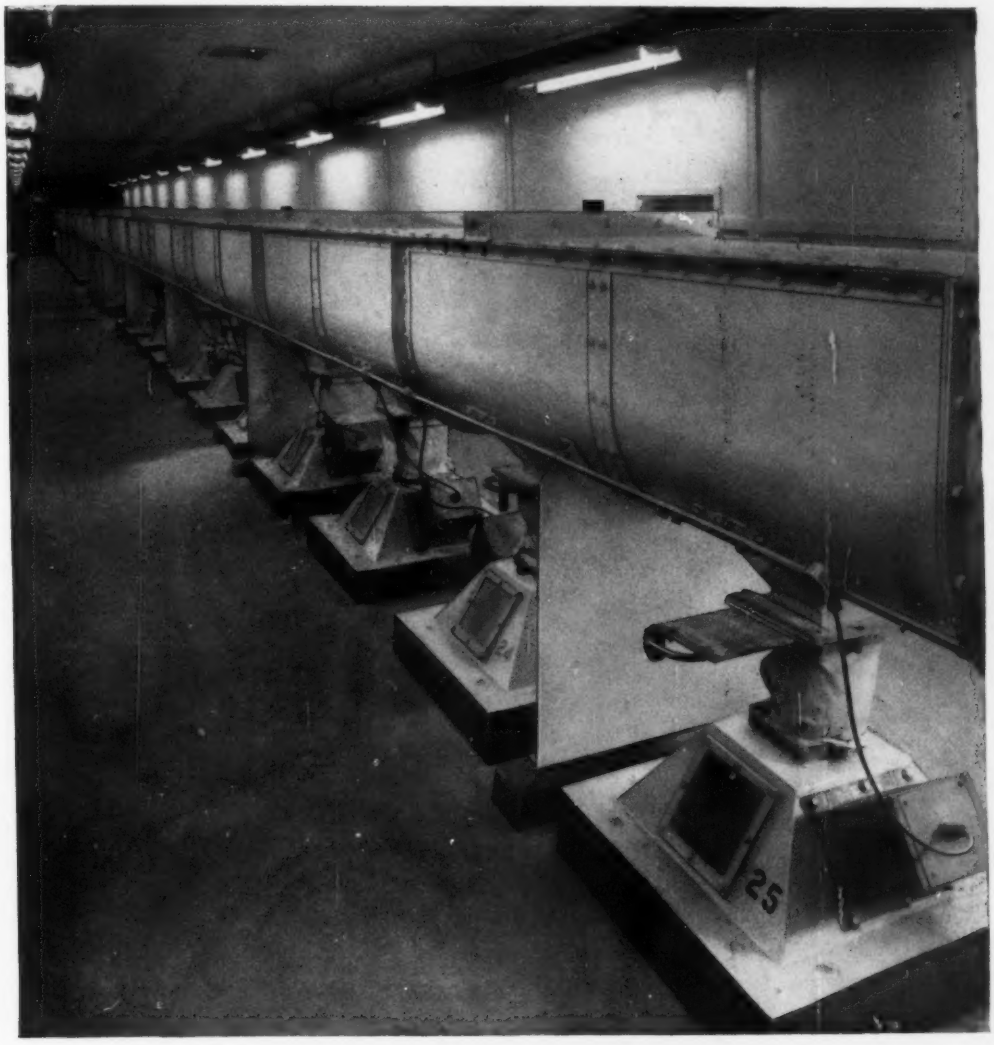

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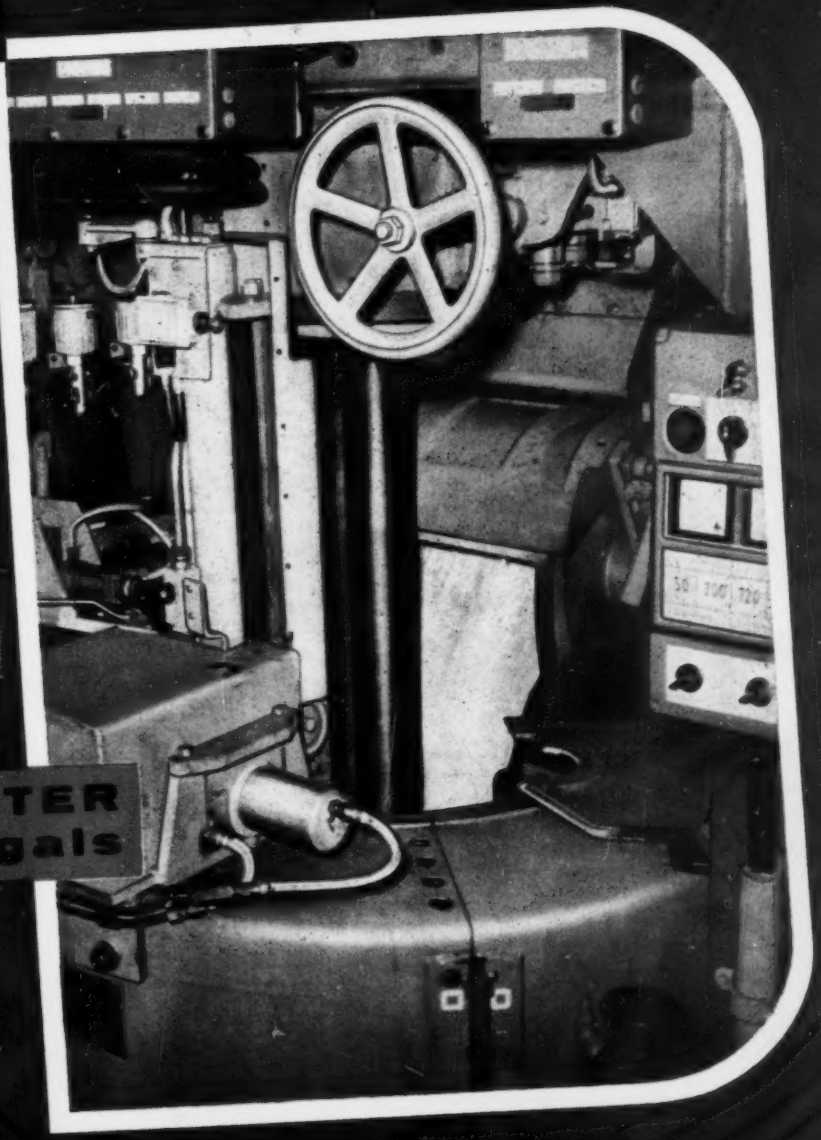

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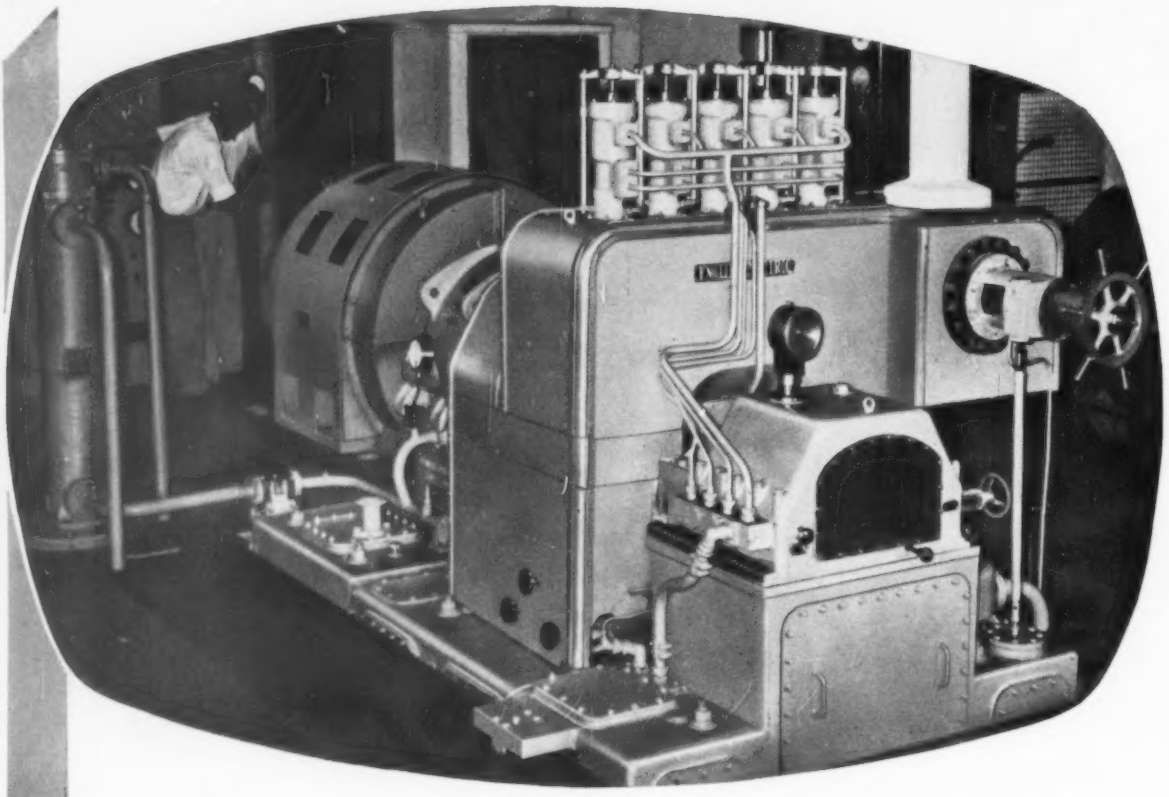

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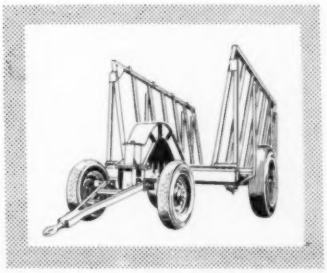

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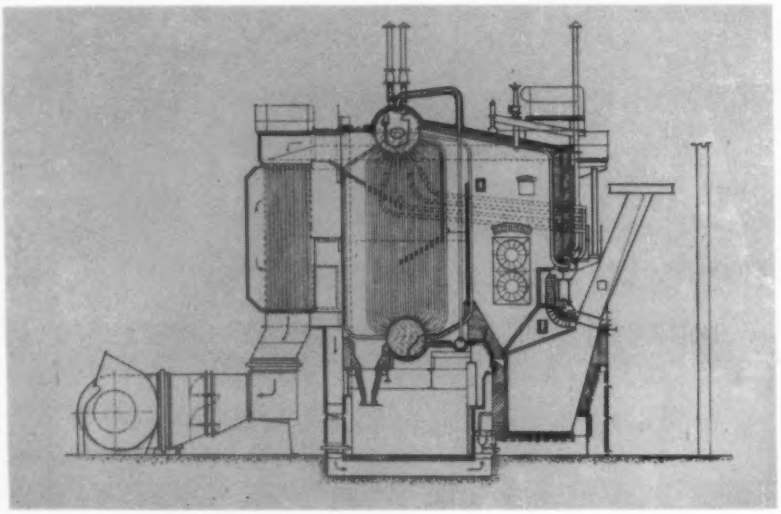

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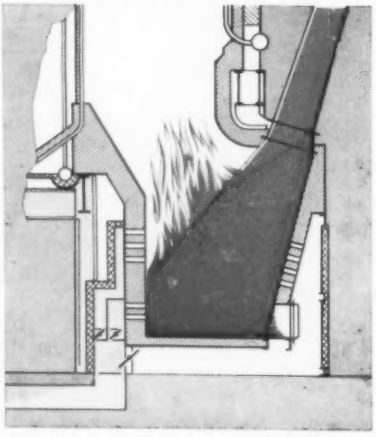

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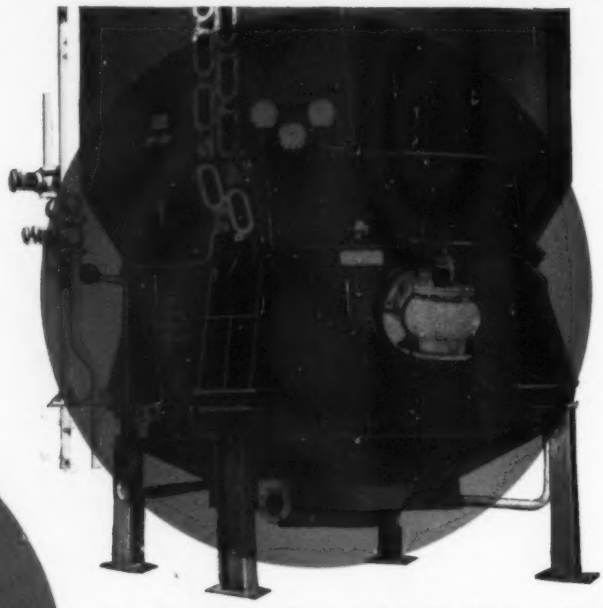

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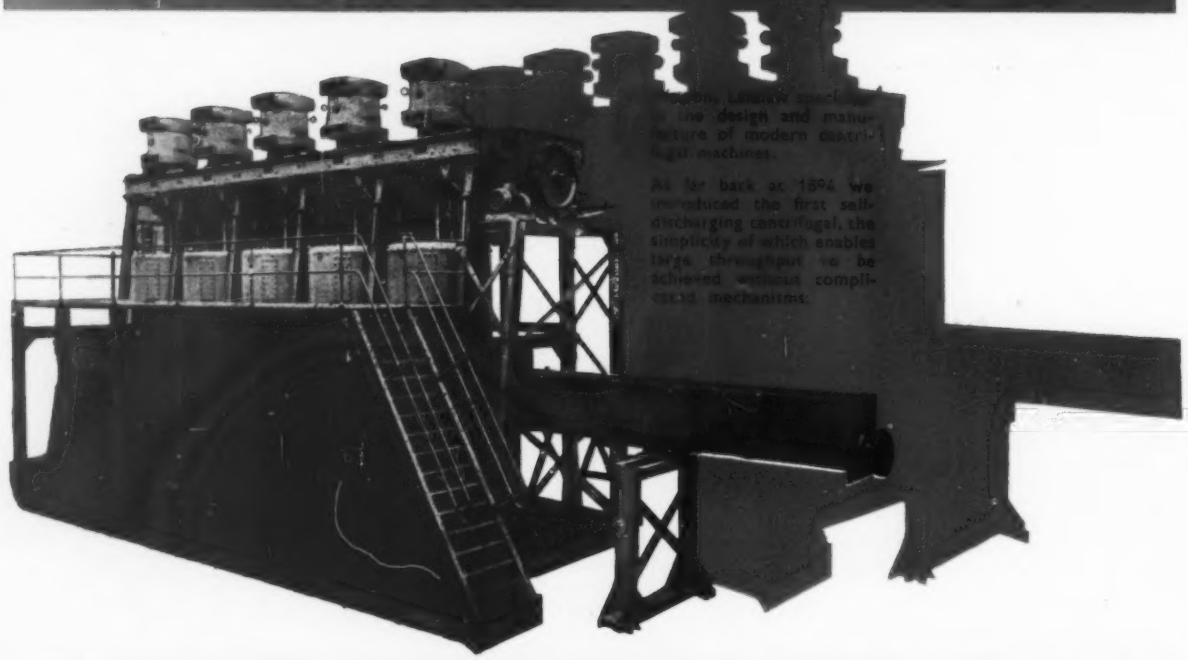

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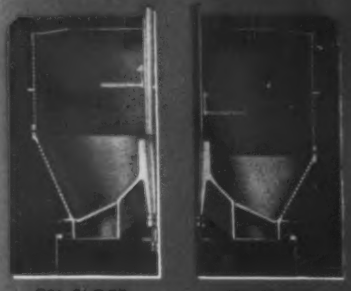

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METHODS FOR THE ASSESSMENT OF BEET QUALITY

By A. CARRUTHERS and J. F. T. OLDFIELD
(British Sugar Corporation Ltd., Research Laboratories, Bramcote, Nottingham, England)

(*Paper presented to the 11th Meeting, Commission Internationale Technique de Sucrerie, September*, 1960)

Part III—Summation of Non-Sugars

The foregoing methods of analysis are suitable for the assessment of the effects of individual non-sugars on beet quality. For a general assessment of quality, some method of compounding the individual results is required to permit comparison of the quality of, for example, a sample having a low potassium and a high amino-acid content with another sample having a high potassium and a low amino-acid content.

It is frequently suggested that molasses production, and hence juice quality, is determined solely by the sum of the number of g-atoms of potassium, sodium and calcium. The authors do not consider this viewpoint to be correct, but it is immediately apparent that a measure of potassium and sodium in beet will not be sufficient to provide an estimate of the beet quality. Beet having a low potassium and sodium content cannot be considered to have a high quality unless there is a corresponding reduction in the nitrogenous non-sugars. The general lack of rainfall in the 1959 season was associated with an abnormally low potassium concentration per 100 sugar in beet in many European countries. In Britain the potassium concentration per 100 sugar was on average nearly 20% less than in the previous year but a smaller percentage of the sugar in the beet was crystallized in the low potassium season. The lower extraction arose because, although the inorganic cations were reduced, the nitrogenous non-sugars were present at a higher concentration per 100 sugar. It is probable that, of themselves, the nitrogenous compounds contribute to molasses production in the factory process, but it is certain that a high ratio of certain nitrogenous compounds to inorganic cations increases molasses production because, with such a ratio, the available alkalinity in the clarified juice is inadequate for the achievement of low lime salts and the maintenance of pH in the sugar end unless large amounts of soda ash are added. The addition of the soda ash increases the production of molasses.

The assessment of beet quality therefore requires the consideration of several non-sugar constituents but, for a routine assessment, it is obviously desirable to reduce the number of constituents that have to be measured to a minimum. The question then arises as to which non-sugars should be considered and how much weight should be allocated to each constituent. Choice of non-sugars must to some extent be dependent on any programme of breeding selection for any particular component which must be determined in addition to the bulk non-sugars. About 70% of the non-sugars in the second carbonatation filtrate have been found to consist of potassium and sodium salts, amino acids (plus p.c.a.) and betaine. There are no significant differences between the potassium, sodium or betaine concentrations per 100 sugar in aqueous extracts of brei, in raw juice and in second carbonatation juice except in so far as the sodium concentration may be increased by soda ash additions. Small amounts of glutamic acid, aspartic acid and other amino acids are eliminated in clarification but this loss is negligible in comparison with the total amino acid content and the Moore and Stein nitrogen in the *brei extract* provides a reliable estimate of the total amino acids plus p.c.a. in the second carbonatation juice. The soda ash addition is in part determined by the ratio of amino acids to those anions, associated with potassium and sodium, which are eliminated in clarification, but it is also partly determined by the amount of invert and of acid fermentation products of sucrose which are produced in diffusion. The soda ash addition is therefore not solely a function of the quality of the beet but is also influenced by the efficiency of the factory operation. The addition that may be required at any particular factory cannot be forecast precisely from analysis of beet. Nevertheless it has been found that the following method of summation of the three groups of compounds, which can be determined in brei extract, provides a total which is closely correlated with the purity of the second carbonatation juice produced in practice at factories having quite different methods of diffusion and clarification. The summation has been successfully applied for both the 1958 and 1959 seasons although, between these two seasons, the relative proportions of the non-sugar components changed considerably.

The total obtained by this summation is therefore considered to provide a suitable measure of the quality of the beet.

Method of summation

The basis of the summation is to estimate the extent to which each of the groups, as measured in the brei extract, would contribute to the non-sugars in the second carbonatation juice.

Although some of the anions associated with the potassium and sodium in the brei extract are eliminated in clarification, the hydroxyl ion concentration in the second carbonatation juice is negligible and consequently the potassium and sodium are still associated with equivalent anions after clarification. Some of these anions, such as lactate, are produced during diffusion and clarification. To estimate the weight of potassium and sodium salts in the clarified juice it is necessary to assign an arbitrary mean equivalent weight for the associated anions. Of the principal anions, chloride has the smallest equivalent weight, 35·5, while the equivalent weight of lacate is 90. Some of the associated anions, for example, p.c.a. will have been summated separately with the amino acids. A mean equivalent weight of 58 has been assumed so that the potassium and sodium salts are calculated to be equal respectively to 2·5 and 3·5 times the weight of potassium and sodium per 100 sugar.

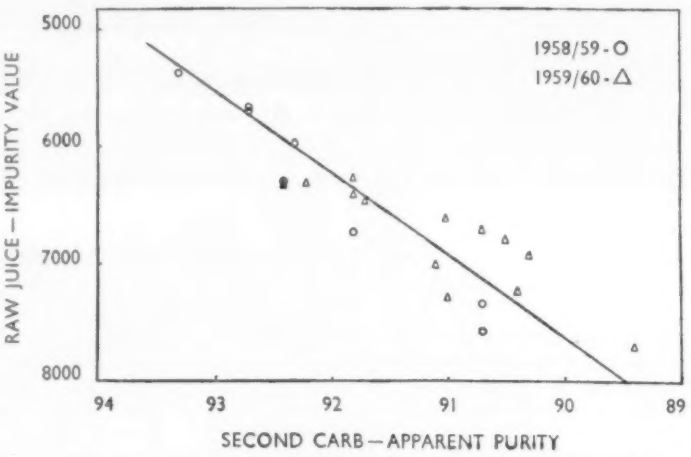

Fig. 1. Comparison of raw juice impurity and second carbonatation juice apparent purity.

Glutamine represents about two-thirds of the total amino acids in the brei extract. Only the amino nitrogen in the glutamine molecule reacts with the Moore and Stein reagent so that with a molecular weight of 146, the weight of glutamine is 10·5 times the contribution to the Moore and Stein value. Much of the glutamine is converted to p.c.a. during clarification but the total weight of non-sugar is not greatly reduced. The molecular weight of most of the other amino acids is less than that of glutamine but, since the amino acids are one of the causes of soda ash additions, the ultimate weight contribution of the amino acids to the second carbonatation juice non-sugars may exceed the sum of the individual molecular weights. It is therefore assumed that the effective weight of the amino acids and their degradation products in the second carbonatation juice is equal to ten times the Moore and Stein nitrogen per 100 sugar in the brei extract.

Betaine passes unchanged through the factory process and the contribution of this compound to the non-sugars in the second carbonatation juice is equal to the betaine concentration per 100 sugar in the brei extract.

The summation, assessing the contribution of the principal non-sugars in the second carbonatation juice in terms of the values measured per 100 sugar in the brei extract, is therefore:—

Impurity Value = 2·5 Potassium + 3·5 Sodium + 10 Moore & Stein Nitrogen + Betaine.

Results

The application of the method of summation to give a single "impurity value" may be illustrated by comparing the purity of the second carbonatation juice samples from British Sugar Corporation factories in the 1958/59 and 1959/60 seasons with the totals obtained by applying the above factors to analytical results for the corresponding raw juices. The individual analytical results have been reported previously[1,3] and are not recorded below but they can be calculated by application of the summation factors to the calculated contributions recorded in Table IV.

Table IV

Comparison of second carbonatation juice purity and impurity value calculated from raw juice analysis

Factory and year	Purity 2nd Carb	Contribution of Principal Non-Sugars based on Raw Juice analysis (mg/100S) 2·5K	3·5Na	10M&S	Betaine	Impurity Value
1958/59—						
Cantley	93·3	2660	420	1040	1250	5370
Colwick	92·7	2890	330	1240	1200	5660
Brigg	92·7	2950	300	1160	1280	5690
Poppleton ..	92·4	3030	280	1550	1440	6300
Kelham	92·3	3160	360	1270	1180	5970
Kidderminster	91·8	3330	430	1690	1280	6730
Spalding ..	90·7	3900	480	1920	1270	7570
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Purity = 100·9—(0·00143 × impurity value). The correlation coefficient is —0·89 which is highly significant.

Since purity is a measure of non-sugars per 100° Bx. whereas the impurity values are calculated per 100 sugar, the correlation should not be quite linear but the deviation is slight at high purities in which range the theoretical relationship between true purity and 70% of the non-sugars expressed as mg/100 S is:—

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The impurity value can be calculated from analysis of aqueous extracts of brei and, since the summation provides a measure not only of the total non-sugars but also of the contribution of each of the principal constituent groups, the method provides a valuable means for the assessment of the quality of beet.

Appendix

The following methods have been found satisfactory for the individual determination of the principal anions in aqueous extracts of beet or brei. The extracts should be centrifuged before analysis to remove suspended matter.

(a) *Nitrate*.—Interfering ions are removed by a modification of the ion exchange procedure of Jones and Underdown [15]. An aliquot containing 3 g sugar is acidified with 1·0 ml of 30% phosphoric acid and 1 ml of a 25% solution of urea is added. The mixture is heated to 60–70°C for 10 min to destroy nitrite and, after cooling, the precipitate is removed by centrifugation. The supernatant liquor is then applied to a column of "Amberlite IR 4 B" and eluted as described by Jones and Underdown. Nitrate is then determined in the eluate by nitration of 2–4 xylenol using the method of Barnes [16].

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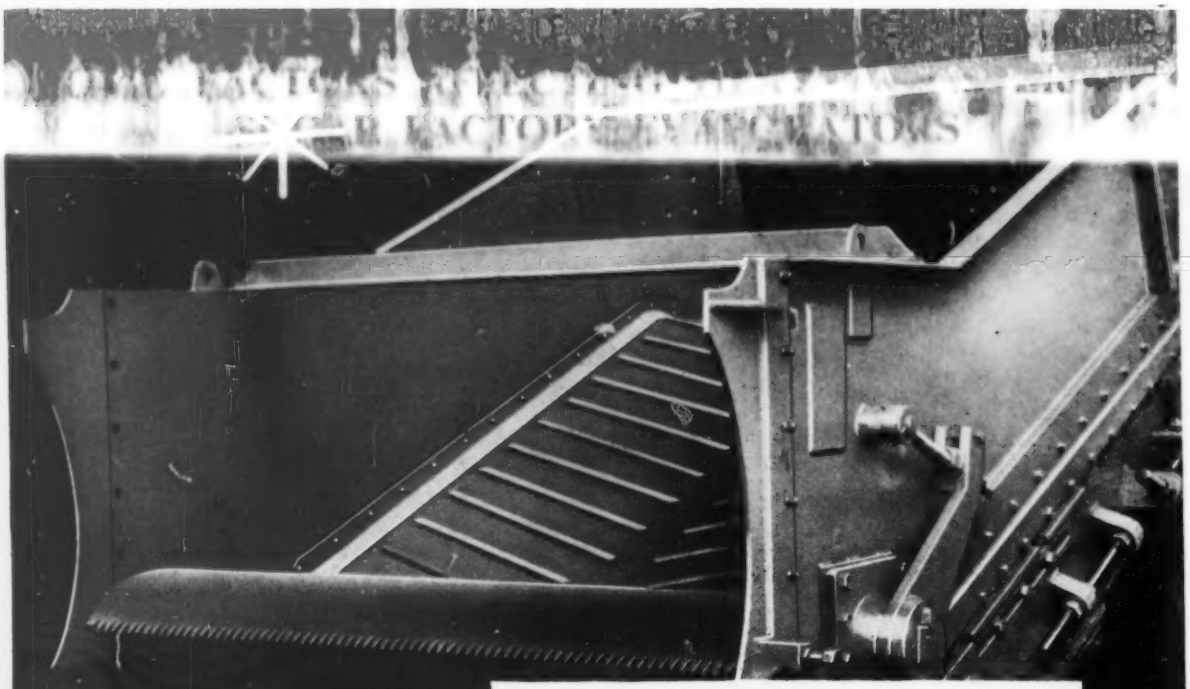

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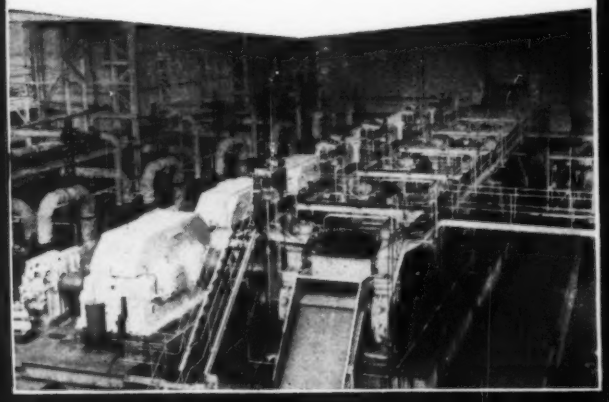

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PS08

METHODS FOR THE ASSESSMENT OF BEET QUALITY

By A. CARRUTHERS and J. F. T. OLDFIELD
(British Sugar Corporation Ltd., Research Laboratories, Bramcote, Nottingham, England)

(*Paper presented to the 11th Meeting, Commission Internationale Technique de Sucrerie, September*, 1960)

Part III—Summation of Non-Sugars

The foregoing methods of analysis are suitable for the assessment of the effects of individual non-sugars on beet quality. For a general assessment of quality, some method of compounding the individual results is required to permit comparison of the quality of, for example, a sample having a low potassium and a high amino-acid content with another sample having a high potassium and a low amino-acid content.

It is frequently suggested that molasses production, and hence juice quality, is determined solely by the sum of the number of g-atoms of potassium, sodium and calcium. The authors do not consider this viewpoint to be correct, but it is immediately apparent that a measure of potassium and sodium in beet will not be sufficient to provide an estimate of the beet quality. Beet having a low potassium and sodium content cannot be considered to have a high quality unless there is a corresponding reduction in the nitrogenous non-sugars. The general lack of rainfall in the 1959 season was associated with an abnormally low potassium concentration per 100 sugar in beet in many European countries. In Britain the potassium concentration per 100 sugar was on average nearly 20% less than in the previous year but a smaller percentage of the sugar in the beet was crystallized in the low potassium season. The lower extraction arose because, although the inorganic cations were reduced, the nitrogenous non-sugars were present at a higher concentration per 100 sugar. It is probable that, of themselves, the nitrogenous compounds contribute to molasses production in the factory process, but it is certain that a high ratio of certain nitrogenous compounds to inorganic cations increases molasses production because, with such a ratio, the available alkalinity in the clarified juice is inadequate for the achievement of low lime salts and the maintenance of pH in the sugar end unless large amounts of soda ash are added. The addition of the soda ash increases the production of molasses.

The assessment of beet quality therefore requires the consideration of several non-sugar constituents but, for a routine assessment, it is obviously desirable to reduce the number of constituents that have to be measured to a minimum. The question then arises as to which non-sugars should be considered and how much weight should be allocated to each constituent. Choice of non-sugars must to some extent be dependent on any programme of breeding selection for any particular component which must be determined in addition to the bulk non-sugars. About 70% of the non-sugars in the second carbonatation filtrate have been found to consist of potassium and sodium salts, amino acids (plus p.c.a.) and betaine. There are no significant differences between the potassium, sodium or betaine concentrations per 100 sugar in aqueous extracts of brei, in raw juice and in second carbonatation juice except in so far as the sodium concentration may be increased by soda ash additions. Small amounts of glutamic acid, aspartic acid and other amino acids are eliminated in clarification but this loss is negligible in comparison with the total amino acid content and the Moore and Stein nitrogen in the *brei extract* provides a reliable estimate of the total amino acids plus p.c.a. in the second carbonatation juice. The soda ash addition is in part determined by the ratio of amino acids to those anions, associated with potassium and sodium, which are eliminated in clarification, but it is also partly determined by the amount of invert and of acid fermentation products of sucrose which are produced in diffusion. The soda ash addition is therefore not solely a function of the quality of the beet but is also influenced by the efficiency of the factory operation. The addition that may be required at any particular factory cannot be forecast precisely from analysis of beet. Nevertheless it has been found that the following method of summation of the three groups of compounds, which can be determined in brei extract, provides a total which is closely correlated with the purity of the second carbonatation juice produced in practice at factories having quite different methods of diffusion and clarification. The summation has been successfully applied for both the 1958 and 1959 seasons although, between these two seasons, the relative proportions of the non-sugar components changed considerably.

The total obtained by this summation is therefore considered to provide a suitable measure of the quality of the beet.

Method of summation

The basis of the summation is to estimate the extent to which each of the groups, as measured in the brei extract, would contribute to the non-sugars in the second carbonatation juice.

Although some of the anions associated with the potassium and sodium in the brei extract are eliminated in clarification, the hydroxyl ion concentration in the second carbonatation juice is negligible and consequently the potassium and sodium are still associated with equivalent anions after clarification. Some of these anions, such as lactate, are produced during diffusion and clarification. To estimate the weight of potassium and sodium salts in the clarified juice it is necessary to assign an arbitrary mean equivalent weight for the associated anions. Of the principal anions, chloride has the smallest equivalent weight, 35·5, while the equivalent weight of lacate is 90. Some of the associated anions, for example, p.c.a. will have been summated separately with the amino acids. A mean equivalent weight of 58 has been assumed so that the potassium and sodium salts are calculated to be equal respectively to 2·5 and 3·5 times the weight of potassium and sodium per 100 sugar.

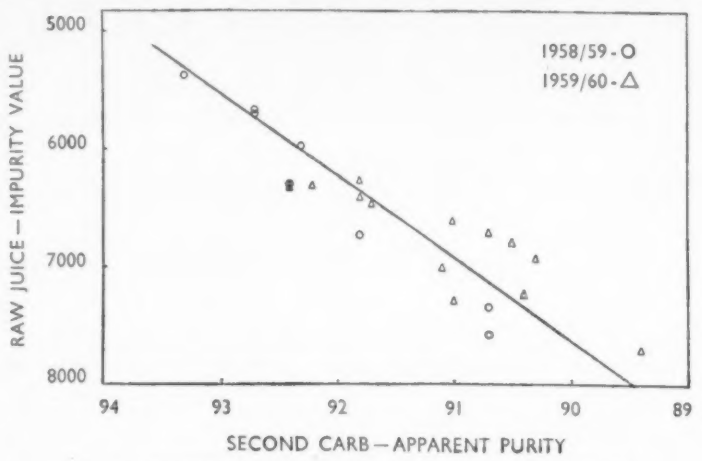

Fig. 1. Comparison of raw juice impurity and second carbonatation juice apparent purity.

Glutamine represents about two-thirds of the total amino acids in the brei extract. Only the amino nitrogen in the glutamine molecule reacts with the Moore and Stein reagent so that with a molecular weight of 146, the weight of glutamine is 10·5 times the contribution to the Moore and Stein value. Much of the glutamine is converted to p.c.a. during clarification but the total weight of non-sugar is not greatly reduced. The molecular weight of most of the other amino acids is less than that of glutamine but, since the amino acids are one of the causes of soda ash additions, the ultimate weight contribution of the amino acids to the second carbonatation juice non-sugars may exceed the sum of the individual molecular weights. It is therefore assumed that the effective weight of the amino acids and their degradation products in the second carbonatation juice is equal to ten times the Moore and Stein nitrogen per 100 sugar in the brei extract.

Betaine passes unchanged through the factory process and the contribution of this compound to the non-sugars in the second carbonatation juice is equal to the betaine concentration per 100 sugar in the brei extract.

The summation, assessing the contribution of the principal non-sugars in the second carbonatation juice in terms of the values measured per 100 sugar in the brei extract, is therefore:—

Impurity Value = 2·5 Potassium + 3·5 Sodium + 10 Moore & Stein Nitrogen + Betaine.

Results

The application of the method of summation to give a single "impurity value" may be illustrated by comparing the purity of the second carbonatation juice samples from British Sugar Corporation factories in the 1958/59 and 1959/60 seasons with the totals obtained by applying the above factors to analytical results for the corresponding raw juices. The individual analytical results have been reported previously[1,3] and are not recorded below but they can be calculated by application of the summation factors to the calculated contributions recorded in Table IV.

Table IV

Comparison of second carbonatation juice purity and impurity value calculated from raw juice analysis

Factory and year	Purity 2nd Carb	Contribution of Principal Non-Sugars based on Raw Juice analysis (mg/100S) 2·5K	3·5Na	10M&S	Betaine	Impurity Value
1958/59—						
Cantley	93·3	2660	420	1040	1250	5370
Colwick	92·7	2890	330	1240	1200	5660
Brigg	92·7	2950	300	1160	1280	5690
Poppleton ..	92·4	3030	280	1550	1440	6300
Kelham	92·3	3160	360	1270	1180	5970
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SOME FACTORS AFFECTING HEAT TRANSFER IN SUGAR FACTORY EVAPORATORS

By P. P. KING, M.A., A.M.I.Chem.E.

WITH a view to gaining a greater insight into some of the factors affecting heat transfer in sugar factory evaporators a number of experimental runs have been carried out using the triple effect evaporator of the model sugar factory of the Imperial College of Tropical Agriculture* and the triple effect evaporator at Reform Factory, Trinidad; data supplied by the Monymusk factory in Jamaica have also been examined. When short runs were carried out evaporation rates were determined by direct measurement of total condensate from the appropriate calandrias and/or calculated from flow-meter readings; for long runs a material balance based on factory data was used. Temperatures were determined by averaging a large number of thermograph readings or alternatively deduced from pressure/vacuum gauge readings with suitable corrections. Where possible cross-checks were made, e.g. between evaporation rates calculated from Brix differences and those obtained from condensate weights and between boiling temperatures calculated from pressure readings and those measured directly.

The general heat transfer equation $Q = UA\theta$ is written as $Q = A\theta/R$:
where Q = Heat flux;
U = Overall heat transfer coefficient;
A = Steam side value of area across which heat is transferred;
R = Overall thermal resistance;
θ = Overall temperature difference.

The use of R rather than U is preferred since thermal resistances are directly additive and effects of steam-side fouling, scale formation, etc. are more readily recognised.

The actual calculation of true values of R for different vessels in a multiple-effect evaporator is somewhat laborious, involving corrections for flash evaporation between vessels, boiling point elevations, vapour bleed, etc., and depends on the form of the original data. A typical worked example is given by KING and WISE[1] where the increase in overall thermal resistance with scale formation is shown. It should be pointed out that essentially steady-state operation has been a basic requirement in all this work and no attempt has been made to examine an evaporator where this condition did not hold, e.g. one where vapour was bled to vacuum pans.

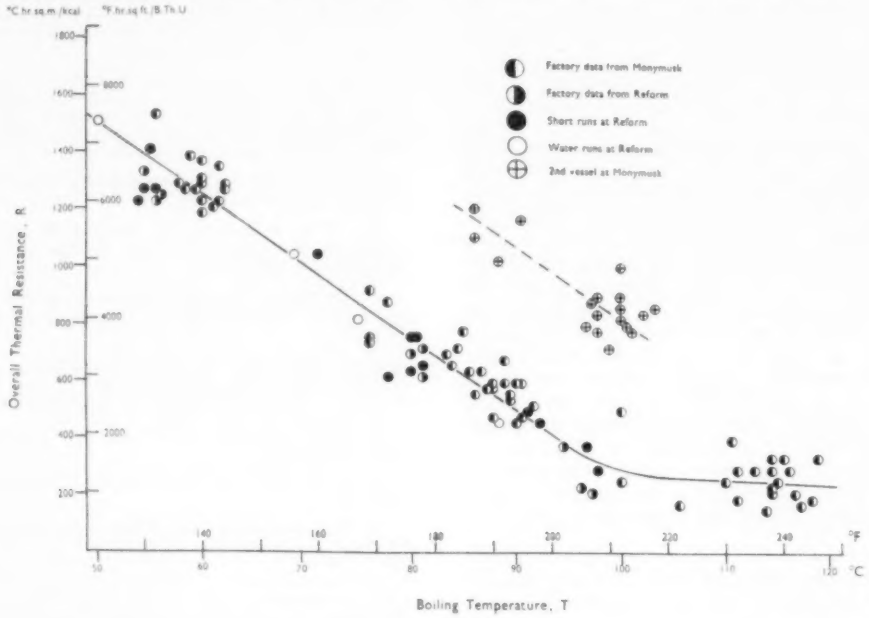

Fig. 1.

The results of plotting R against the boiling temperature of the juice in the vessel are shown in Fig. 1. For clarity's sake only a representative portion of the data is given. There is a good correlation even though the results were obtained at different times and with different methods from a relatively small "triple" (3,165–2,370–2,370 sq. ft.; 294–220–220 sq. m.) and a large "quad" (12,500–6,250–6,250–6,250 sq. ft.; 1,160–580–580–580 sq.). The anomalous results from the second vessel of the Monymusk "quad" were subse-

*Now University College of the West Indies, Faculty of Agriculture (I.C.T.A.).

[1] *Proc. B.W.I. Sugar Tech.* 1960, (in press).

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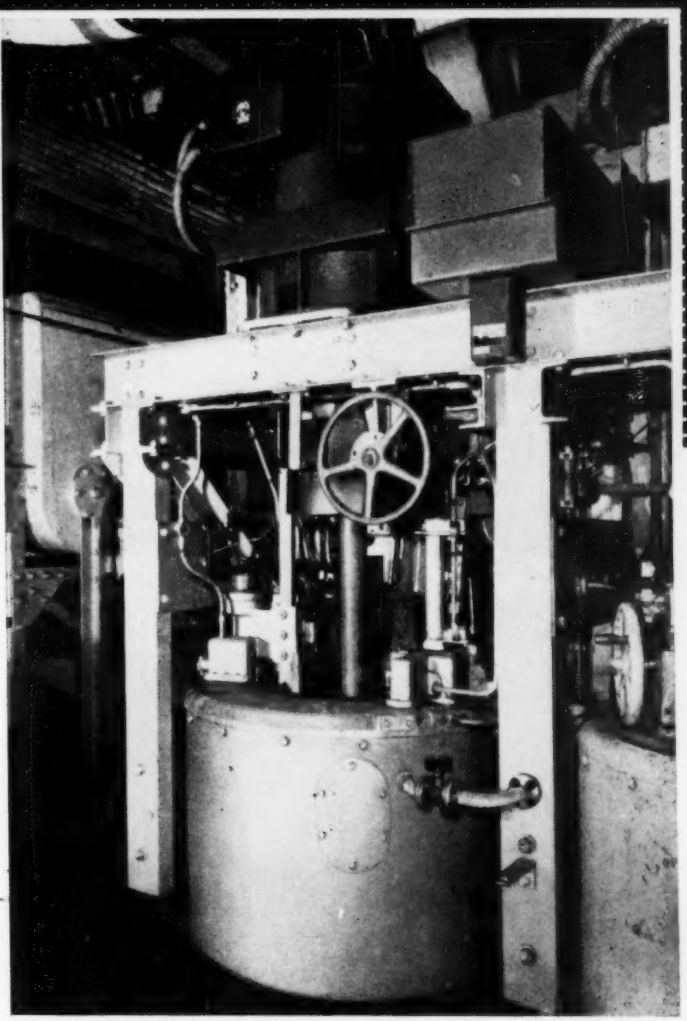

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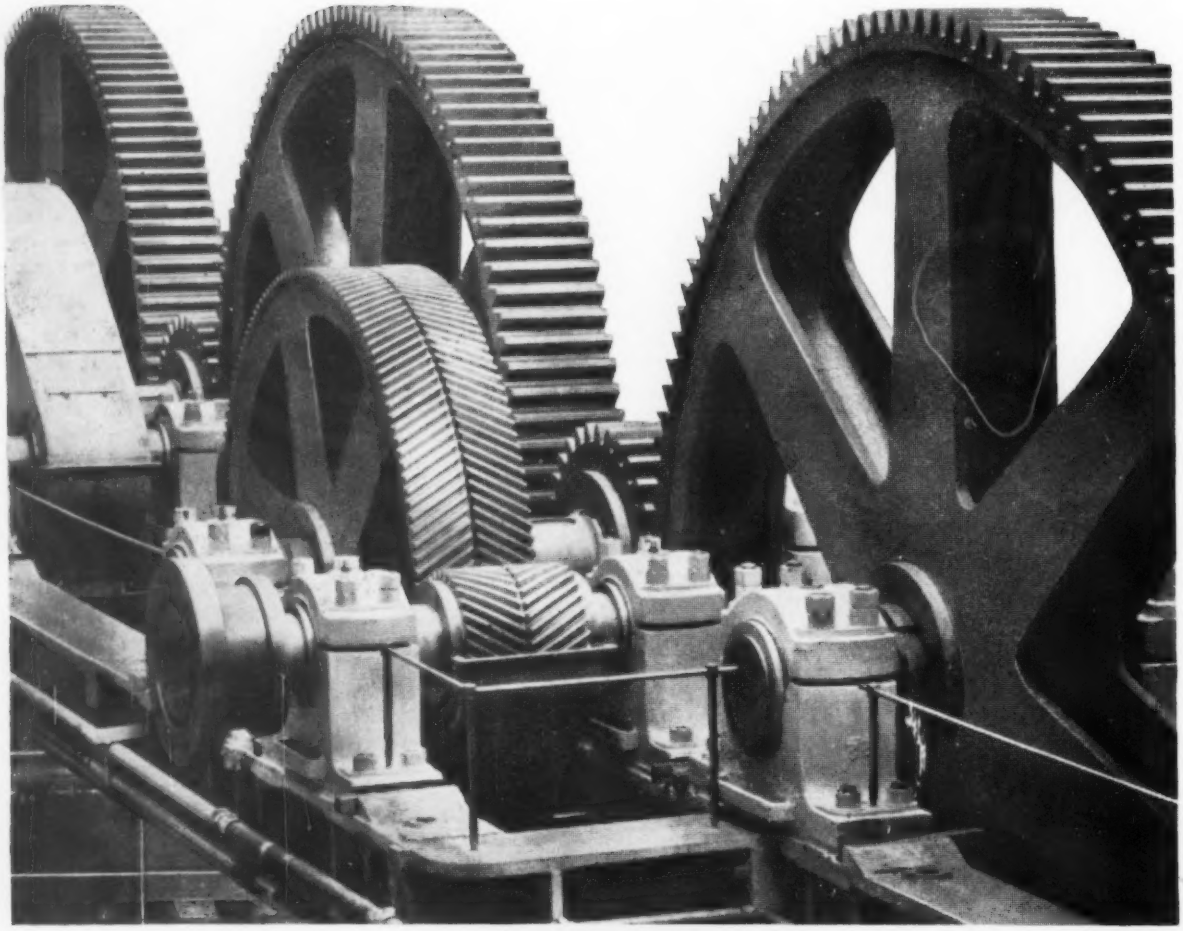

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quently shown to be caused by heavy steam-side fouling. When the vessel was retubed a layer of some 6 in to 8 in (15–20 cm) of carbonized material was found in the bottom of the steam chest and a thick deposit of similar material was found on the tubes. With an example as glaring as this no special treatment is required to show the presence of an extra thermal resistance, but the correlation is useful when the effects are smaller and would otherwise be obscured by variation in boiling temperature.

It will be noticed that the plot does not follow a straight line through the results for the first vessel of the Monymusk evaporator. It is clear that at these high boiling temperatures the juice side thermal resistance has become so small that those of the steam-side and the brass tube itself now contribute a significant proportion to the overall value and little further decrease is possible. In conventional notation, U, the overall heat transfer coefficient has reached a value

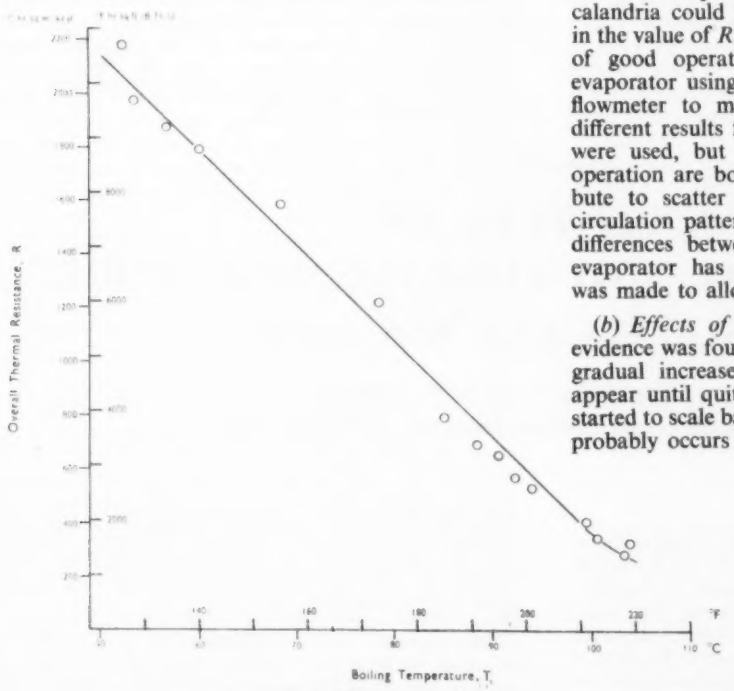

Fig 2

of approximately 1000 B.Th.U./hr. sq. ft. °F (4900 kcal/hr/sq. m./°C). The slope of the straight part of the line is approximately -7×10^{-5}hr. sq. ft./B.Th.U. ($-2{\cdot}58\times10^{-5}$ hr. sq.m./kcal.).

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The scatter of the results shown in Fig. 1 might be attributed to a number of causes:

(*a*) *General difficulties in making measurements of this type.*—It was shown with some runs on the I.C.T.A. evaporator that inadequate venting of a calandria could produce the expected large increase in the value of R; adequate venting is assumed as part of good operation. Runs made on the Reform evaporator using an orifice type differential pressure flowmeter to measure the feed rate did not give different results from those where daily factory data were used, but some departures from steady-state operation are bound to occur and these will contribute to scatter in the results. Differences in the circulation pattern between evaporators may lead to differences between the plots. (A sealed-downtake evaporator has not been examined.) No attempt was made to allow for hydrostatic head effects.

(*b*) *Effects of scale formation.*—Surprisingly little evidence was found of scale formation. The expected gradual increase of R through the week did not appear until quite recently when Reform evaporator started to scale badly[1], but some slight scale formation probably occurs from time to time.

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[2] HUGOT: (translated by JENKINS), "Handbook of Cane Sugar Engineering". (Elsevier, Amsterdam) 1960. p. 417.
[3] FOUST *et al.*: *Ind. Eng. Chem.*, 1939, **31**, 206.
[4] WISE: *Industr. Chem.*, 1960, **36**, 434.

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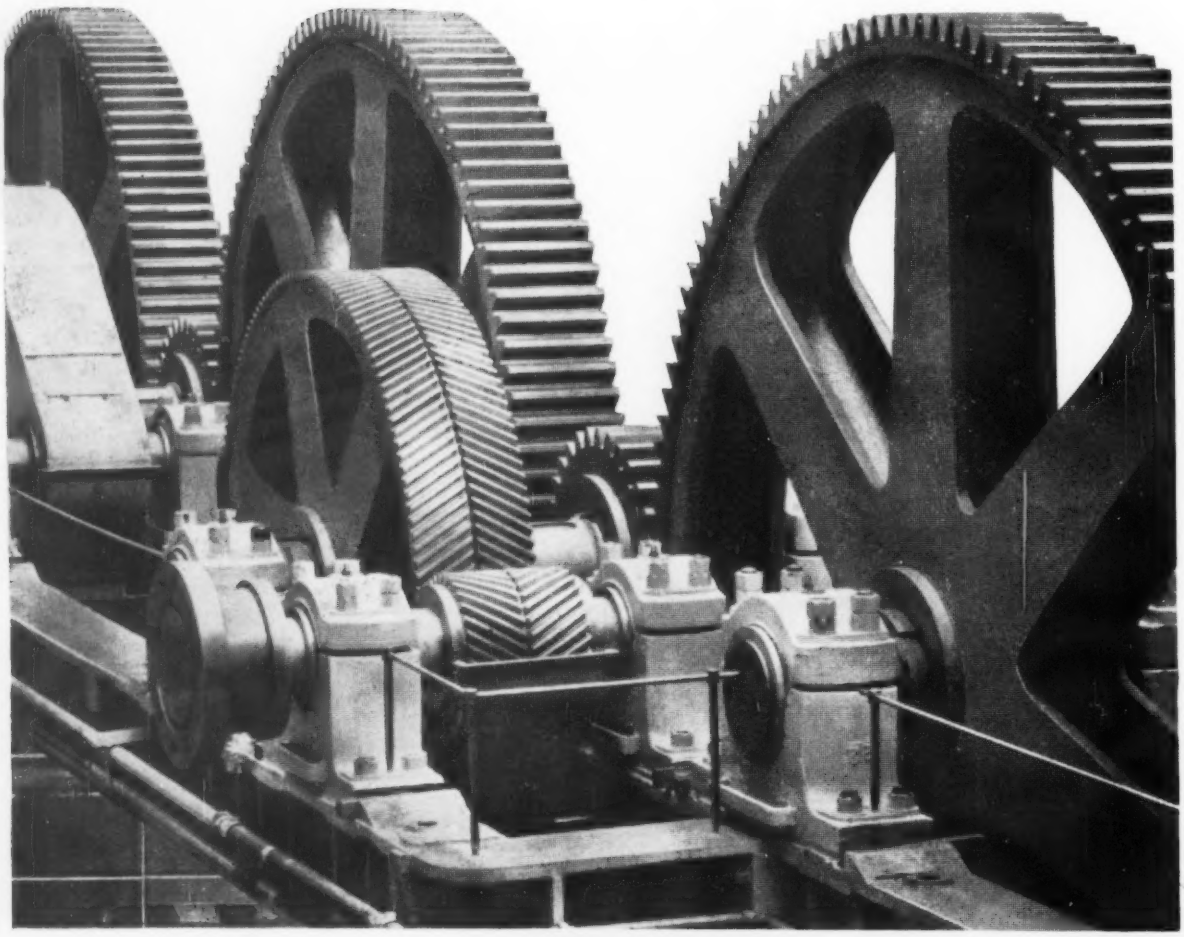

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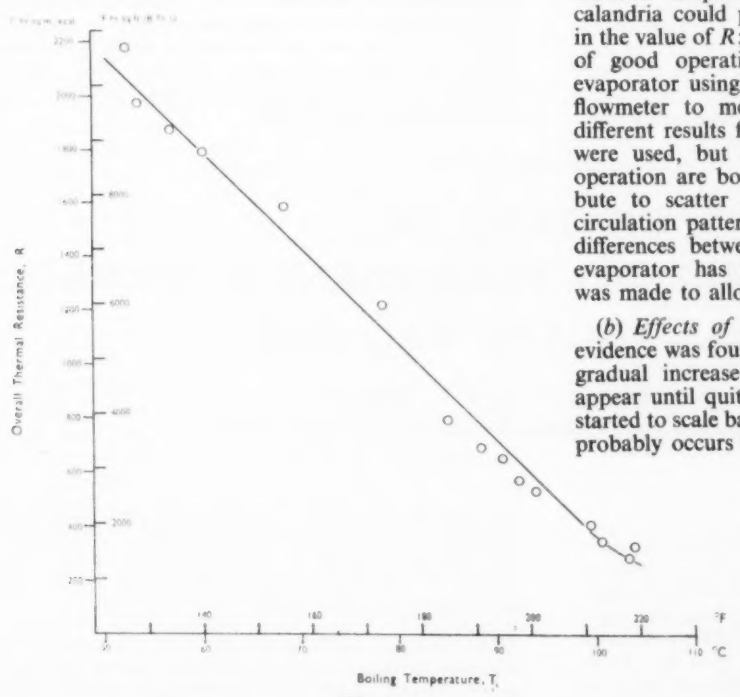

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[3] FOUST *et al.*: *Ind. Eng. Chem.*, 1939, **31**, 206.
[4] WISE: *Industr. Chem.*, 1960, **36**, 434.

available show it to hold approximately for the conditions encountered.

(*e*) *Variations of R with Brix.*—The variation of *R* with Brix had been expected to be large but results from Reform with water in all three vessels contradicted this view. It is difficult under normal working conditions to secure a wide range of concentration in any one vessel of an evaporator, especially if other variables are to be held constant. Variation of Brix from 54° to 67° in the last vessel at Reform showed no significant effect on overall thermal resistance. In a further experiment the overall thermal resistance of the last vessel of the Reform evaporator was determined on the last day of the 1960 crop. The vessel was boiled under an average vacuum of 25·5 in Hg (648 mm Hg), with a temperature difference of 49°F (27·2°C) and the mean syrup Brix was 59·7°. The value of *R*, calculated from factory data. was 8·2°F.hr.sq.ft./B.Th.U. (1·68°C.hr.sq.m./kcal) and was high as a result of scale formation. On the following day, while steam was still available, water coloured by small amounts of juice and syrup left in the evaporator was boiled under 25·8 in Hg (655 mm Hg) vacuum with a 46°F (25·6°C) temperature difference. The value of *R* calculated from condensate measurements, was then found to be approximately 8·0°F.hr.sq.ft./B.Th.U. (1·64°C.hr.sq.m./kcal.) If a Brix effect exists it is clearly small over the range of conditions studied. Preliminary studies in the 60–80° Brix range carried out in a miniature vacuum pan show that here the effect of Brix on thermal resistance is very marked and accords more closely with the conventional view.

While work remains to be done on this subject (particularly with regard to temperature head effects) it is felt to be worthwhile publishing these results, as the form of the plot in Fig. 1 (i.e. $R = f(T)$) is of value in tackling a number of design and operation problems; in particular it forms the basis for a new graphical approach to multiple effect evaporation[4].

The author wishes gratefully to acknowledge the help with the calculations he has received from Mr. W. S. WISE, to thank Mr. R. D. E. YEARWOOD for his assistance in the work with the I.C.T.A. evaporator and Messrs. B. V. MASSIAH and R. F. WOTHERSPOON for theirs with the Reform evaporator. Thanks are also due to the Usine Ste. Madeleine Sugar Company (Reform Factory) and the West Indies Sugar Co. Ltd, (Monymusk Factory) for supplying much valuable information.

A CENTURY OF UTILIZATIONAL AND FUNDAMENTAL WORK ON SUGARCANE BAGASSE

By V. R. SRINIVASAN and S. R. PATHAK
Department of Chemistry, Osmania University, Hyderabad, India

PART I

THE sugar cane plant has been known since ancient times and a mention of it is found in the early literature of various countries. During the earlier days of its utilization, the well-known uses of two products of sugar cane, viz., cane sugar and molasses, probably threw into the background the importance of other materials such as bagasse, wax, etc. which can also be derived from this crop. The scanty knowledge then available on such cellulosic raw materials as well as the difficulty in the transport of this bulky material, perhaps, limited the avenues for the application of bagasse. Another factor that may have contributed to this neglect may have been the plentiful availability, in those days, of better raw materials for the manufacture of paper. Even now, bagasse is considered in many quarters only as a cheap, locally available fuel, although of low calorific value.

However, in the light of the increasing demand of suitable cellulosic raw materials for various purposes and on the basis of a greater understanding and increased technical know-how of the processing of this residue, bagasse is coming into its own. The history of this fascinating development extends to more than a hundred years.

The present world production of raw sugar is reported[1] to be of the order of fifty million tons per annum, out of which about twenty-eight million tons are manufactured from sugar cane, which should leave a considerable amount of bagasse. It is estimated[2] that improvements in the fuel efficiency of sugar-houses would release about a fourth to a third of this amount of bagasse for uses other than as fuel. Exploration of the economic feasibility of using alternative fuels in sugar houses would make more bagasse available for proper exploitation. These features have aroused the interest of various workers

[1] F. O. Licht, *International Sugar Report*, 1958, **90**, (11), 1; *I.S.J.*, 1959, **61**, 31.

[2] Quoted in "Experience in industrial bagasse pulping", F.A.O. ST/ECLA/CONF.3/L.5.7, 1st October 1954; p. 6.

and over a thousand references are cited in the relevant literature on the nature and modes of utilization of bagasse. WEST[3] has compiled a number of important references in this field in an annotated bibliography.

Although the earliest regular analyses[4–7] of sugarcane bagasse appear to have been carried out only during the period 1890–1910, a process for pulping bagasse was suggested[8] even in 1838. It has been said that bagasse was shipped to France from Martinique in 1844 for use in the manufacture of paper[9]. Quite a few patents have been taken out in the U.S.A. during the sixties and eighties of the last century; in 1864, on the digestion[10] of bagasse by the alkaline cooking liquor left after the pulping of wood; in 1871, on the pulping[11] of bagasse with sodium carbonate, sodium sulphate, chlorine and quicklime; in the same year[12] on the removal of siliceous matter from bagasse by treatment with soda, followed by fermentation, and, in 1883, on the invention[13] of an apparatus for disintegrating bagasse with lime, soda and steam. These early patents reveal the extent of interest attached to this residue even in those days.

Though a commercial attempt[14] to produce paper from bagasse appears to have been made in France in 1884, later reports tend to point out the shortcomings of bagasse as a raw material for this purpose. Thus, in a book[15] published in 1894 on the chemistry of paper making, a reference was made to the difficulties encountered in the manufacture of paper while using bagasse as a raw material, such difficulties being attributed to the presence of pith. HOFMANN[16] pointed out in 1897 other shortcomings such as larger consumption of alkali during its processing and the higher silica content in the resulting pulps and questioned its commercial value.

A lack of proper appreciation of these points left in its trail some costly failures in attempts to produce paper from bagasse. Thus a plant which was set up in 1908 in Brazil for producing paper from bagasse[9] had to be closed down in a short time. In contrast to this and a few other expensive failures during this period in attempts to produce paper from bagasse, were the successful ventures to produce wall-boards and similar products from bagasse in admixture with other materials, made particularly famous by "Celotex", manufactured by the Celotex Corporation at Marrero in Louisiana, from 1922 onwards. The reasons for the earlier failures are not far to seek. It had become possible by then to appraise the significance of the heterogeneous nature of bagasse. This heterogeneity is not manifested to any great extent in the chemical composition of the different fractions of bagasse as brought out in a large number of chemical analyses[5,17–21] of these fractions, reported from various parts of the world. However, the complex physical aggregation of fibrous cells from the rind, fibrovascular bundles and vessel segments and non-fibrous parenchymatous material - pith - in bagasse, behaves differentially during the pulping operations. The variety and the nature of these cells can be gauged from VAN DILLEWIJN's book[22] where a comprehensive account of the anatomy of the stem of the sugar cane plant has been given.

Although the pithy material is chemically the same as the fibrous cells, the lack of a fibrous structure and its ovoidal shape cause a greater adherence of dirt to this fraction. Furthermore, its lesser resistance to chemical attack leads to a larger consumption of chemicals resulting in the necessity of using large volumes of fluid in the digesters. Difficulties in the actual paper-making operations are also caused by the presence of pith on account of hindered filtration, slower drainage on the wire, sticking at the press rolls and the poorer bleachability of the product. In general, it may be said that the presence of pith renders the pulp unsuitable for conversion into high grade products and reduces the rate at which the paper can be made.

DEPITHING

Although the necessity for the removal of as much pith as possible before processing the fibre of bagasse appears to have been realised as early as 1890, when FRITSCH took out a patent[23] for the partial removal of pith from bagasse, serious attention to this problem was paid only from about 1910 onwards. The present tendency in this direction seems to be motivated not only toward obviating the difficulties caused by the presence of pith in bagasse during its pulping, but also to utilising the separated pith for the production of many useful materials. For instance, it can be

[3] "Utilization of sugar cane bagasse for Paper, Board, Plastics and Chemicals—An Annotated Bibliography" 2nd ed. (Sugar Research Foundation Inc., New York, N.Y.) 1952.

[4] THIELE: *Chem. Ztg.*, 1901, **25**, (27), 289; *J. Soc. Chem. Ind.*, 1901, **20**, 495.

[5] BROWNE: *J. Amer. Chem. Soc.*, 1904, **26**, 1221.

[6] GEERLIGS: *Archief*, 1906, 445; quoted by NOEL DEERR; "Cane Sugar" (Norman Rodger, Manchester) 1911, p. 411.

[7] REMINGTON *et al.*: *World's Paper Trade Rev.*, 1909, **52**, 729; *J. Soc. Chem. Ind.*, 1910, **29**, 16; *Chem. Abs.*, 1910, **4**, 826.

[8] ATCHISON: *Paper Trade J.*, 1952, **134**, (25), 24; *I.S.J.*, 1954, **56**, 42.

[9] Quoted in "Bagasse for pulp and paper", F.A.O., ST/ECLA/CONF.3/L.5.0; 1st October 1954, p. 1.

[10] DIXON: U.S.P. 45,321 (Dec. 6, 1864); (70), p. 27 in ref. 3.

[11] DENIS: U.S.P. 113,502 (April 11, 1871); (65), p. 26 in ref. 3.

[12] ROTHE: U.S.P. 121,130 (Nov. 21, 1871); (337), p. 122 in ref. 3.

[13] HARANG: U.S.P. 278,545 (May 29, 1883); (124), p. 47 in ref. 3.

[14] Quoted in "Experience in industrial bagasse pulping", ST/ECLA/CONF.3/L.5.7; 1st October 1954, p. 1.

[15] GRIFFIN and LITTLE: "The Chemistry of paper making", (Lockwood, New York) 1894; No. 104, p. 40, in ref. 3.

[16] "Praktisches Handbuch der Papier-Fabrikation" (Verlag der Papier-Zeitung, Berlin) 1897 ; (138), p. 51 in ref. 3.

[17] WREDE: (435), p. 156 in ref. 3.

[18] KUMAGAWA and SHIMOMURA: *Zeit. angew. Chem.*, 1923, **36**, 414; *I.S.J.*, 1923, **25**, 663.

[19] LATHROP and ARONOVSKY: *Tappi*, 1954, **37**, (12), 24A.

[20] KNAPP *et al.*: *ibid.*, 1957, **40**, (8), 595; *I.S.J.*, 1959, **61**, 219.

[21] PATHAK and SRINIVASAN: *Indian Pulp and Paper*, 1958, **12**, 429; *I.S.J.*, 1960, **62**, 328.

[22] "Botany of Sugarcane", (Chronica Botanica Co., Waltham, Mass., U.S.A.) 1952. pp. 11–19.

[23] U.S.P. 432,825 (July 22, 1890); (96), p. 38 in ref. 3.

used as a filler for explosives[24, 25], absorbent for blackstrap molasses[34, 36], animal feed[26] and for the preparation of furfural[27]. WELLS and ATCHISON have reported[28] that the addition of as much as 70% pith to kraft pulp promotes the formation and improves the appearance and stiffness of paper board. BIRDSEYE[29] suggests that pith added at the end of cooking of the fibrous portion of bagasse confers some advantages to the product obtained. Processing of pith by the action of diastase to obtain glucose has also been suggested by MARSDEN[30]. A variety of other uses to which pith can be put have also been indicated[31–33].

Repeated attempts [29, 34–39] have, therefore, been made to evolve a suitable process for depithing, but even now the methods are far from perfect. In general, the various methods[40–43] that have been developed for depithing bagasse are all based on the mechanical separation of the pith cells from the fibre. This separation is carried out after a preliminary loosening of the bonds between the pith and fibre by rod mills[26, 38], hammer mills[44] or single disc attrition mills[40, 43]. The processes in general use are divided into dry, moist and wet methods.

In dry methods, the bales of bagasse are broken and subjected to hammering or rubbing. They are then screened to remove about half of the pith and dirt. Further removal of pith results in a considerable loss of the fibre. Though the fibre thus obtained still holds much dirt, this process is practiced even now in many places on account of its simplicity and low capital investment.

Moist methods are based on the separation of pith from the fibre of bagasse as obtained directly from the sugar factories, containing about 50% moisture. In these methods, the bagasse is subjected to combing and shredding and the loosened pith is removed by screening or by a directed flow of water, which causes the pith to come to the surface, whence it is removed. One recent development in this type of method is the "Horkel Process"[45, 46] named after its inventors HORTON and KELLER of the University of Louisiana. It is claimed that this method is adaptable for the dry and wet depithing processes also.

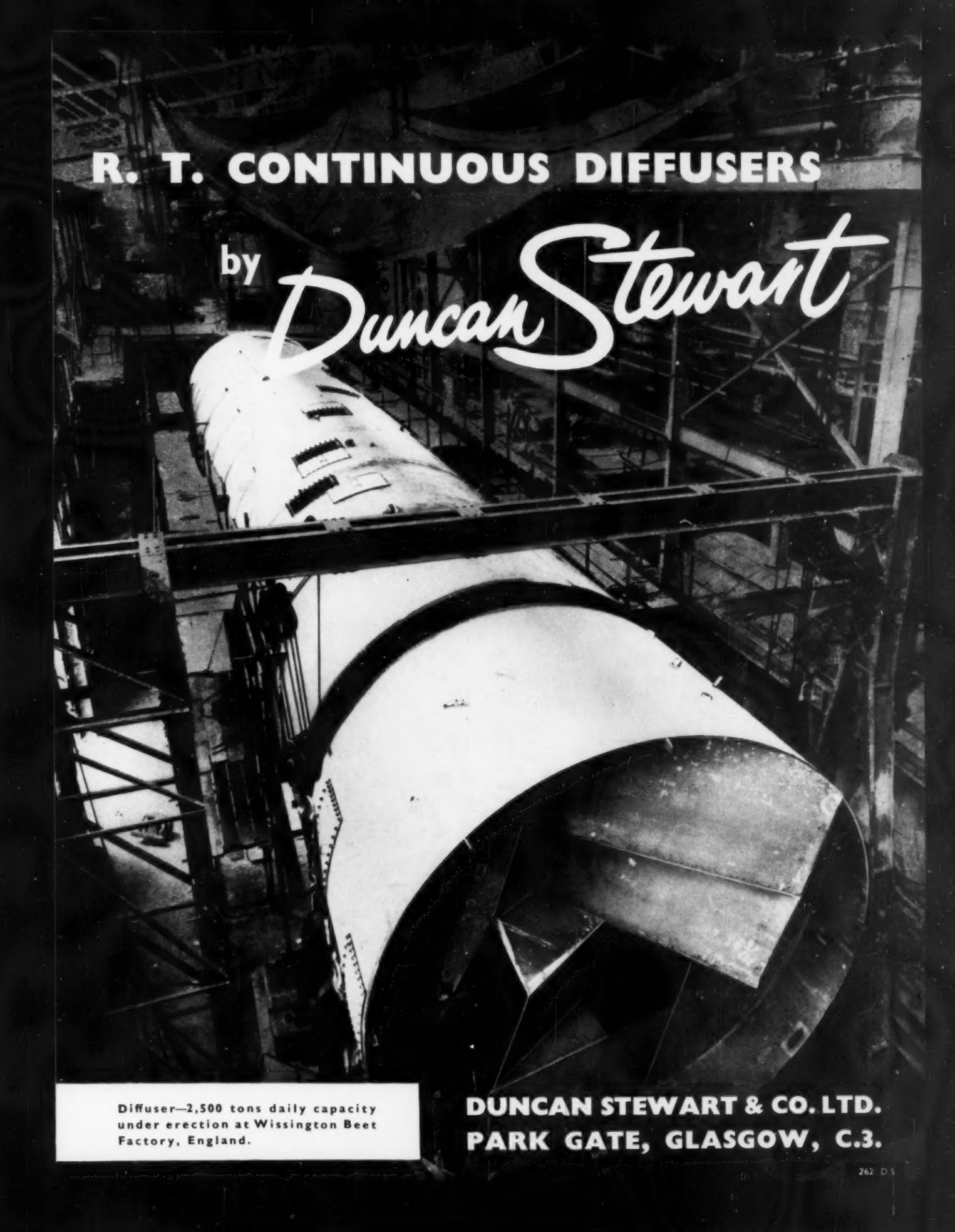
The wet methods for depithing bagasse are, by far, the most common. These methods are based on the separation of pith from bagasse which has been soaked in water for some time. A method[43] developed at the Northern Utilization Research Laboratory at Peoria is based on the dilution of bagasse from sugar mills to a suitable level and passing it first through a disc refiner and subsequently through sugar mill rolls to get a 50% dry product, which is directly screened to remove the pith or screened after passage through a rotary drier. Success on a commercial scale has been claimed for this method also.

Another wet method[43], adopted by the Hawaiian Sugar Planters' Association, is based on subjecting a suspension of bagasse to the action of a hydrapulper and then effecting the removal of dirt, pith and water solubles on a depithing machine. It employs the Rietz Depithing System[47] consisting of a vertical-shaft, free-swinging hammer mill provided with a differential discharge. It is claimed that the fibre obtained in this process is very satisfactory by virtue of its pulp yield, unbeaten freeness and that the paper produced from this type of pulp has high brightness and burst factors, breaking length and folding endurance. The whole process appears to need only a few minutes for completion and is considered to be suitable as a rapid, continuous depithing process. STUCK[48] advocated an enzymatic method for loosening pith from the fibre bundles of bagasse, by using heat-resistant enzymes followed by agitation and screening.

Usually the moist methods are applied in the sugar mills for the use of fibre in an ancillary pulp mill. In these cases the depithed fibre is directly processed into pulp or is baled and stored. Both dry and wet methods are adopted when stored bagasse has to be depithed. Bagasse is usually stored[49, 50] after a surface spraying of boric acid solution or other suitable reagents and stacking the bales in such a fashion as to allow the escape of gases formed by fermentation of the residual sugars.

(*To be continued*)

[24] LATHROP: (182), p. 66 and (184), p. 67 in ref. 3.
[25] ANON.: (25), p. 17 in ref. 3.
[26] ARONOVSKY and NELSON: *Tappi*, 1951, **34**, 216.
[27] MIYAKE *et al.*: *J. Soc. Trop. Agric.*, [Taihoku (Taipei) Imp. Univ.], 1942, **14**, 189; *Chem. Abs.*, 1948, **42**, 3175.
[28] *Paper Trade J.*, 1941, **112**, (13), 34; *I.S.J.*, 1941, **43**, 377.
[29] U.S.P. 2,862,814 (December 2, 1958); *I.S.J.*, 1959, **61**, 123.
[30] U.S.P. 1,265,694 (May 7, 1918); *I.S.J.*, 1918, **20**, 527.
[31] ANON.: (231), p. 88 in ref. 3.
[32] MCMULLEN: (225), p. 86 in ref. 3.
[33] ARTHUR D. LITTLE INC.: (214), p. 80 in ref. 3.
[34] LEE: U.S.P. 1,155,741 (October 5, 1915); *Chem. Abs.*, 1915, **9**, 3358.
[35] O'ROURKE: U.S.P. 1,260,437 (March 26, 1918); *I.S.J.*, 1919, **21**, 149.
[36] SCOTT: U.S.P. 1,399,891 (December 31, 1921); *I.S.J.*, 1922, **24**, 279.
[37] KUMAGAWA and SHIMOMURA: U.S.P. 1,818,897 (August 11, 1931); *Chem. Abs.*, 1931, **25**, 5561.
[38] WELLS: U.S.P. 2,029,973 (February 4, 1936); *Chem. Abs.*, 1936, **30**, 2000.
[39] ARTHUR D. LITTLE INC.: *H.S.P.A. Expt. Sta. Bull.*, 1919, (46), 51 pp.; *I.S.J.*, 1920, **22**, 453–460, 505–508.
[40] Ref. 9, pp. 26-27.
[41] LATHROP *et al.*: "Methods for separating pith-bearing Plants into Fiber and Pith" USDA ARS 71-74, March 1955, pp. 18–19.
[42] LATHROP: *Indian Pulp and Paper*, 1955, **10**, 119, 173.
[43] ATCHISON: *ibid.*, 1957, **12**, 41.
[44] MCQUISTON and LOESECKE: U.S.P. 1,813,184 (July 7, 1931); *Chem. Abs.*, 1931, **25**, 5286; (227), p. 86 in ref. 3.
[45] HORTON and KELLER: U.S.P. 2,650,176 (August 25, 1953); *I.S.J.*, 1954, **56**, 146.
[46] KELLER: *Indian Pulp and Paper*, 1958, **13**, 26.
[47] Quoted by KNAPP *et al.*: *Tappi*, 1957, **40**, 606.
[48] U.S.P. 2,839,398 (June 17, 1958); *I.S.J.*, 1958, **60**, 373.
[49] MUNROE and LATHROP: U.S.P. 1,833,493 (November 24, 1931); *Chem. Abs.*, 1932, **26**, 1122 and related patents.
[50] CHAPMAN: "Purchasing, handling and storing of bagasse", F.A.O. ST/ECLA/CONF.3/L.5.5, 1st October 1954, pp. 6–9.



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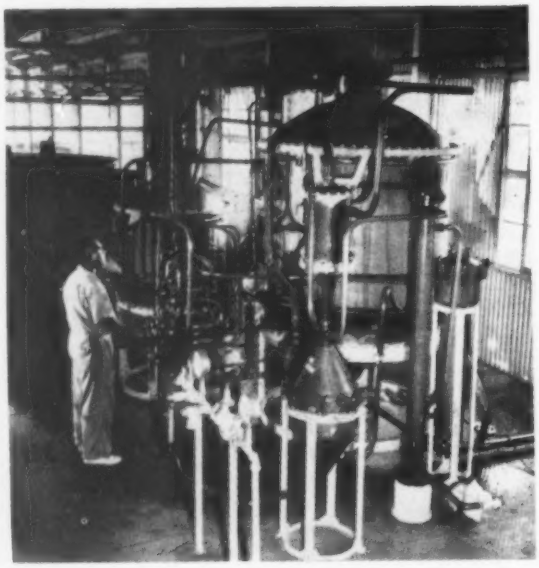

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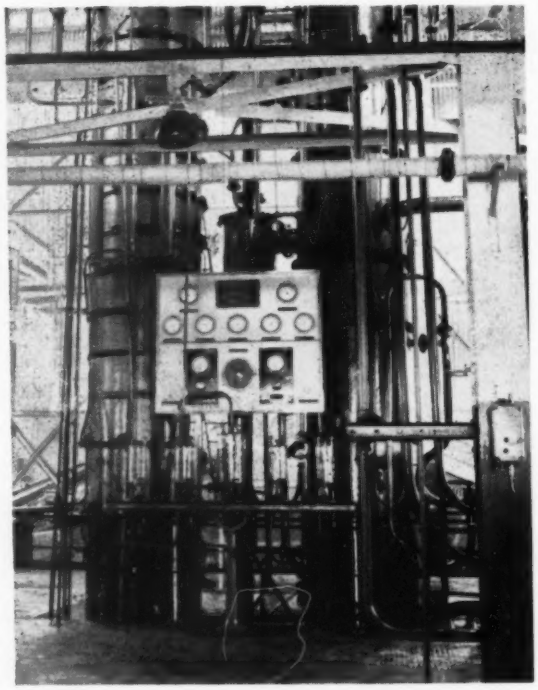

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SUGAR-HOUSE PRACTICE

Formation of false grains in the crystallization process of sugar and its effect. A. C. RAHA. *Proc. 10th Congr. I.S.S.C.T.*, 1959, 277–282.—The factors determining whether false grain is formed in a pan are: the prevailing crystal growth rate, available surface area, and supersaturation. Although the second can be controlled at the start of a strike, these are generally unknown at any point during boiling. Theoretical considerations based on pure sucrose solutions or 2- or 3-component systems are considered inapplicable to the multi-component system found in cane sugar manufacture. Accordingly experiments were carried out on growth rates in massecuites which could be related to conditions favouring false grain formation. Samples were withdrawn from a pan at 5-min intervals at the beginning, mid-way through and at the end of a strike and the crystals separated, washed with alcohol and weighed to determine the rates of crystal growth. Boiling was continued until false grain formed; syrup was then added to dissolve it, and the trial continued. Crystal growth rate was determined by measurement of molasses purity in the case of *C*-massecuites. In the case of *C*- and some *B*-massecuites, the crystal growth stopped for a time before false grain formed; this indicates that increasing non-sugar concentration inhibits crystal development, perhaps by absorption on the surface, since this effect is not found with *A*-massecuites. The difficulties caused by false grain—loss of sugar to molasses, low product purity, and purging difficulties—are discussed.

* * *

Sugar crystallization and boiling in presence of a minute quantity of manganous ions. K. SUZUKI. *Proc. 10th Congr. I.S.S.C.T.*, 1959, 305.—In the presence of 0·00001–0·001% manganous sulphate, a 60% sucrose solution produces crystals which are colourless, contain less reducing sugar, are not cloudy, have angles and edges, are light bluish-white (as against white or light yellowish-white), are produced in a shorter time and higher yield, with less frothing in the case of low grade products, and have only two (101) faces as opposed to four (101) faces in the normal sugar crystal. Large crystals are also different in form.

* * *

A note on factory recovery. R. R. FOLLETT-SMITH. *Proc. 10th Congr. I.S.S.C.T.*, 1959, 354–356.—Data from 100 recent factory reports from Caribbean areas, Hawaii, Louisiana and Mauritius were used for comparing recovery of 96° sugar % cane (R) with pol % cane (P). They were found to be close to a straight line graph having an equation R = 1·05 (P—2). Rewritten to give an estimate of pol recovered, the equation is: pol in sugar % cane = 1·008 (P—2) or roughly = P—2. The inference that, irrespective of fibre % cane, pol % cane or juice purity, the pol loss on cane is 2% on average, seems unreasonable; but, in fact, examination of 160 results from one territory gave the figure of 2·04% with a standard deviation of 0·31% and for 85 results from another territory the mean loss was 1·96%, with a standard deviation of 0·19%. Comparison of further results showed no significant differences in bagasse pol loss % cane of different fibre contents. Comparative losses calculated on a basis of % of pol in cane indicated 40% higher losses for one factory than for another; when calculated on a basis of % cane, however, they were of a similar order and in line with the average of all the territories examined.

* * *

Cation exchange in plantation white sugar manufacture. W. CHEN, C. T. YU and Y. C. CHENG. *Proc. 10th Congr. I.S.S.C.T.*, 1959, 362–373.—See *I.S.J.*, 1960, **62**, 46.

* * *

Index of milling efficiency. R. QUESADA G. *Bol. Ofic. A.T.A.C.*, 1960, **19**, 275–282.—The index described allows for the rate of milling as well as bagasse analysis and is as follows: Milling efficiency index =

$$\frac{\text{Cane milled per hour (arrobas)}}{\text{Milling loss} \times \text{number of tandems}}$$

Milling loss is expressed as $\frac{\text{Pol \% bagasse}}{\text{Fibre \% bagasse}} \times 100$.

A table gives the factories of Cuba in decreasing order of index from 5199 for Central Cuba to 306 for Central María Antonia.

* * *

Eliminating discoloration in Portuguese East Africa. J. DOS SANTOS ILHA. *Sugar y Azúcar*, 1960, **55**, (10), 49.—Yellowing of white sugar from sulphitation factories was traced at the Bom Jesus factory to the effect of ferric salts in the cane juice. These remain in suspension at liming or are chelated by certain organic acids. At sulphitation the chelates are broken and the ferric iron is reduced, remaining as a colourless impurity. Later, some of this ferrous iron is included in the sugar crystals, and is re-oxidized when the sugar is dried in air, giving the sugar a yellowish hue. The iron is now eliminated by treating the juice with calcium superphosphate and adjusting the pH to 8·0 with milk of lime. The ferrous iron is precipitated as $FeHPO_4$ and the juice sulphitated to pH 6·4 or 6·8. The Oliver filters operate more efficiently and the pol of the filter muds and evaporator scale have been reduced. *A*-massecuites are treated with sodium hydrosulphite to eliminate colouring substances. During the 1959/60 season, white sugar was obtained of comparable quality to sugar obtained by carbonatation.

* * *

Modernization programme at Okeelanta. U. VILLAR LORENZO. *Sugar y Azúcar*, 1960, **55**, (11), 37–39.—New milling plant installed at Okeelanta (Fla.) in the period 1953–59 is described. By the 1961–62 crop the tandem will have been increased from three to six mills. Duncan Stewart steam turbines have proved very satisfactory.

Unique system for bulk unloading. ANON. *Sugar y Azúcar*, 1960, **55**, (11), 40–41.—See *I.S.J.*, 1961, **63**, 85.

* * *

Technical advances in sugar industry and its by-products utilization. A. L. MAZUMDAR. *Indian Sugar*, 1960, **10**, 327–332.—Developments in cane agriculture and in the different factory processes are superficially reviewed. The utilization of bagasse and molasses by-products is also covered.

* * *

Decolorizing ion exchangers. XI. Factory experiences with regeneration and sweetening-off. V. VALTER, Z. MENCL, K. ČIŽ and J. ŠTAMBERG. *Listy Cukr.*, 1960, **76**, 241–246.—Factory tests during two campaigns have proved the expediency of the two-stage regeneration of decolorizing ion exchangers, i.e. decolorizing with NaOH and reactivation with NH_4Cl at pH > 7·0–7·5. Decolorization of the syrup was at pH < 8·5. For regeneration and sweetening-off of the exchange resins, the average consumption during 9 hr is 62 kg NaOH, 33 kg HCl and 24 cu. m. water per cu. m. of resin (minimum water consumption was 15 volumes during 11 hr). For regeneration, the maximum required water consumption should be 20 volumes during 13 hr. The concentration of NaOH solution at 1·2% is too high and should be reduced. Further reduction in the quantities of chemicals and water consumption is possible by recirculating the eluates. Full details of regeneration and sweetening-off are tabulated for the four resins tested.

* * *

Effect of trash on cane milling. J. C. CHOU. *Taiwan Sugar*, 1960, **7**, (8), 13–18.—Experiments were carried out during the 1959/60 season to determine the effect of trash on cane fibre and milling performance. The cane from a single field was treated in three different ways: cut and topped, with all adhering extraneous matter retained; cleaned manually with 1–2% trash retained (i.e. normal treatment); completely cleaned, with no trash remaining. The first expressed juice, primary juice from the two-roll crusher and first mill juice were analysed, as was the dry crushed bagasse from the first mill. It was found that a 1% increase in the total fibre in cane due to increase of trash would reduce the primary juice extraction by 3·85% or primary pol extraction by 3·12% and the total pol extraction for the complete mill by 0·41%. Juice purity is 3·67 units lower and the sugar yield thus reduced by 0·99, i.e. 7·3% on the yield of clean cane. Crushing capacity is correspondingly lower.

* * *

Conductimetric measurements of high purity sugar syrups. G. PIDOUX. *Ind. alim. agric.*, 1960, **77**, 787–792.—The application of the author's conductivity meter[1] to determination of syrup purities has been tested and various expressions developed for calculation of the purity at various Brix values and temperatures. A general formula is derived which takes the form

$$P = 100\,\frac{(0{\cdot}65 + 0{\cdot}025\,B)[1 + (0{\cdot}00092\,B - 0{\cdot}013)\,(t - 40)]}{(0{\cdot}0247B^2 - 1{\cdot}908B + 36{\cdot}43)\,(mS)_t}$$

where P=purity, B=Brix, t=temperature, and $(mS)_t$=supersaturation at this temperature. Results agree closely with results of laboratory analyses.

* * *

pH in the sugar factory. T. CALDEMAISOUS. *Sucr. Franç.*, 1960, **101**, 217–224, 243–249.—The application of pH as a basis for alkalinity and acidity indications is discussed and two disadvantages are mentioned, which refer particularly to the sugar industry: (1) a scale running from 0 to 14, while all other scales used in the sugar factory are from 0 to 100. (To demonstrate the significance of this, a table is presented of pH values from 0 to 7 in 10th divisions with the corresponding concentrations of aqueous HCl and H_2SO_4.) (2) Variation of the pH with temperature. At the laboratory of the Sucrerie Centrale de Cambrai the range of pH values at each factory process has been determined at 20–23°C and at temperatures from 0 to 100°C. Each process is dealt with in detail and the various reactions and peculiarities connected with pH changes are discussed.

* * *

A decade of great progress in Pakistan's sugar industry. H. KAMPF. *Sugar J.* (La.), 1960, **23**, (6), 10–17.—A review of the Pakistan sugar industry with details of existing mills and mills in course of erection.

* * *

Further experiences with wire-mesh entrainment separators at Bogo-Medellin. C. M. MADRAZO. *Sugar News* (Philippines), 1960, **36**, 436–438.—Experiences with a "Mist Eliminator" type of wire-mesh entrainment separator have shown that installing a large sodium carbonate pump for spraying of the screens increased the area covered but did not soften the scale. Clogging of the outer edges of the screen was accelerated when an "umbrella" device was installed to check sudden juice surges against the screen. The screen may be cleaned by tapping with wooden paddles, but the wire mesh must be straightened where it is dented.

* * *

Modern mill and steam generator at Victorias Milling Company, Inc. E. R. DE LUZURIAGA. *Sugar News* (Philippines), 1960, **36**, 440–448, 449.—Full details are given of the Farrel 18-roller mill and of the Riley 2-drum bagasse-fired boiler, with their ancilliary equipment and controls, etc.

* * *

An evaluation of the recently installed fully automatic recycling centrifugals at Victorias. E. F. GAMBOA. *Sugar News* (Philippines), 1960, **36**, 450–452.—Replacement of 24 belt-driven machines with eight fully-automatic centrifugals for A and B massecuite curing has reduced labour requirements from 36 to 6 men/

[1] *I.S.J.*, 1958, **60**, 297.

24 hr, while other advantages include greater crystal yield, better quality control, increased and flexible capacity, freedom from total breakdown of the whole battery, and savings in steam, power, maintenance and spare parts.

* * *

Cooling of low grade massecuites. C. M. MADRAZO. *Sugar News* (Philippines), 1960, **36,** 454–456.—The shaft and cooling coils of a crystallizer were raised 14 inches and the material in the "dead area" in the bottom of the U-shaped trough was dragged by 30-in long chains, the ends of which were welded to a rod attached to the five arms of the outermost coil. These modifications removed the 5°F difference between the temperatures of the upper and lower portions of massecuite in the crystallizer, and lowered the final molasses purity by 0·5%.

* * *

Pollution abatement in the sugar industry of Louisiana. A. G. KELLER and H. K. HUCKABAY. *J. Water Pollution Control Federation,* 1960, **32,** 755–760; through *S.I.A.*, 1960, **22,** Abs., 953.—After a brief description of cane sugar manufacture, the measures taken in Louisana to abate water pollution are outlined. The main sources of water pollution were condenser water, acid and alkali used for cleaning, floor sweepings, filter cake and cane wash water. For the latter a multi-basin lagooning system was developed. The first of these basins was aerated.

* * *

Drying and cooling granulated sugar at Colonial Sugars Company, Gramercy, Loisuiana. W. R. TUSON. *Tech. Papers and Proc. 19th Ann. Meeting Sugar Industry Technicians Inc.*, 1960, **19,** 161–163; through *S.I.A.*, 1960, **22,** Abs. 983.—A description is given of the sugar factory installation of two tandem sets of Hersey granulators and an additional "Holoflite" unit, together with some operational results.

* * *

Drying and cooling granulated sugar at Revere Sugar Refinery. W. L. REED. *Tech. Papers and Proc. 19th Ann. Meeting Sugar Industry Technicians Inc.*, 1960, **19,** 178–181; through *S.I.A.*, 1960, **22,** Abs. 984.—A description, with a diagram, is given of the installation for sugar drying by means of dehumidified air.

* * *

Drying, cooling and conditioning of granulated sugar with particular emphasis on preparing granulated sugar for bulk storage and shipment. J. P. MANLEY. *Tech. Papers and Proc. 19th Ann. Meeting Sugar Industry Technicians Inc.*, 1960, **19,** 164–166; through *S.I.A.*, 1960, **22,** Abs. 985.—Hersey granulators are used for the drying and first cooling, with "Holoflite" screw conveyor coolers for the second cooling of bulk sugar. The sugar is allowed to stand for some time in a tank before shipment, with filtered air blown through. Some operational figures are given.

Drying, cooling and conditioning of granulated sugar with particular emphasis on preparing granulated sugar for bulk storage and shipment. E. D. GILLETTE. *Tech. Papers and Proc. 19th Ann. Meeting Sugar Industry Technicians Inc.*, 1960, **19,** 159–160; through *S.I.A.*, 1960, **22,** Abs. 986.—Some typical operational data for a Hersey granulator and a "Holoflite" cooler for granulated sugar are given.

* * *

Drying, cooling and conditioning granulated sugar for shipment in bulk. W. W. MCGIMPSEY. *Tech. Paper and Proc. 19th Ann. Meeting Sugar Industry Technicians Inc.*, 1960, **19,** 167–177; through *S.I.A.*, 1960, **22,** Abs. 987.—The conditioning of hot granulated sugar by aeration in storage bins with filtered room air was examined. The moisture content of the sugar was measured indirectly by determining the relative humidity of the air when in equilibrium with the sugar at 72°F by means of a hygrometer placed in a closed sample can. The moisture content of the sugar in the bins drops rapidly during the first two days, and equilibrium is reached after about three days. The results showed that cooling in a "Holoflite" unit before drying retarded the rate of drying in the bins. No drying of sugar was observed during air cooling. Preliminary results with conditioning by means of dried air showed appreciable improvement both in the rate of drying and in the final moisture content of sugar. A finer grain size also gave improvement in the rate of drying.

* * *

Determination of and means of increasing the capacity of push-type continuous centrifugals. E. A. GUSEV. *Sakhar. Prom.*, 1960, (11), 38–39.—For normal working conditions (massecuite Brix at least 88° and temperature = 70°C) the daily capacity of a station of push-type centrifugals of the Escher Wyss type may be calculated from $A = \frac{\pi(R_1^2 - R_2^2)\, L\, \gamma\, z\, \tau\, kn}{100\, \phi\, g}$ zentners of refined sugar per 24 hr, where R_1 = inner radius of the largest basket in m, R_2 = inner radius of sugar layer in the rotating basket, L = length of piston stroke, γ = density of refinery massecuite in kg/cu.m., z = number of pulsations per min, τ = working time of centrifugal in min/day, k = an empirical "coefficient of load", found to be 0·8 in practice, n = number of centrifugals, 100ϕ is a coefficient allowing for the amount of moisture removed from the massecuite (i.e. crystal recovered), and g = refined sugar grade being handled as a proportion of the total refined sugar.

* * *

New technique of cane juice clarification. Survey of progress made. J. M. SAHA, D. L. N. RAO and V. SINGH. *Proc. 27th Conv. Sugar Tech. Assoc. India,* 1959, 11–14.—The Saha-Jain technique as described previously[1] was developed in 1958/59 by adoption of continuous liming and sulphitation with return of clarifier muds, continuous liming to high pH and

[1] *I.S.J.*, 1958, **60,** 299.

continuous neutralization with superphosphate solution and SO_2, using automatic pH and temperature control. The pH control was unsatisfactory and was replaced with manual control. Return of muds to limed and sulphitated juice greatly improved the rate of filtration and largely reduced the stiffening of press cloths. The short duration at high pH obviated the yellow coloration in the sugar. A disadvantage has been the high lime salts content of the clear juice. This is attributed to re-dissolving of muds in the clarifier and leads to excessive formation of albeit soft evaporator scale. It is planned to filter the juice instead of using a clarifier, so as to remove this defect.

* * *

Vapour pans and vapour heaters. K. G. HATHI and T. T. OOMMEN. *Proc. 27th Conv. Sugar Tech. Assoc. India*, 1959, 15–17.—Abnormally high steam consumption in a sugar factory can be avoided by use of a multiple effect evaporator of adequate capacity, and bleeding of vapour from the vapour bodies according to Rillieux's "second principle"[1]. Adoption of the latter at Shimoga sugar factory permitted a doubling of crushing rate without difficulty.

* * *

Choice of pan boiling scheme in a double sulphitation factory. S. P. SANYAL. *Proc. 27th Conv. Sugar Tech. Assoc. India*, 1959, 18–25.—Five boiling schemes are outlined, suitable for different circumstances as to factory capacity, sugar quality required, etc. They are summarized as follows: (I) A 4-massecuite system in which *C* and *D*-sugar is double-cured and remelted. The *A* and *B*-massecuites are built up on syrup-mingled finer sugar from the grader, and the *A* and *B* sugars are double-cured and bagged. (II) A 3-massecuite system in which *C* sugar is double-cured and used as seed for *A* and *B*-sugars which are bagged. (III) A 4-massecuite system similar to (I) but in which the double-cured *C*-sugar is used as *A* and *B* seed instead of remelting. (IV) A 4-massecuite system similar to (III) but in which the double-cured *C*-sugar is bagged. (V) A 4-massecuite system where *A*-massecuites are built up on screened sugar magma and the *B* and *C*-massecuites on double-cured *D*-sugar as seed, *A*, *B* and *C*-sugars being bagged.

* * *

Further work on "suggestion for improving the exhaustibility of final molasses". (Clarification of penultimate or B-heavy molasses.) J. M. SAHA, D. L. N. RAO and V. SINGH. *Proc. 27th Conv. Sugar Tech. Assoc. India*, 1959, 26–32.—Application of the process described earlier[2] to *B*-molasses from double sulphitation and double carbonatation factories is described with tabulated analytical data for the molasses before and after treatment. Single superphosphate was also used as an alternative to triple superphosphate. Purity rises of 8–11 units were found with the sulphitation molasses and 7–9 units with carbonatation molasses. Some invert destruction occurred with the latter. The clarified sulphitation molasses when concentrated to 60°Bx deposited insolubles which were removed after dilution to 40°Bx. This may lead to evaporator scaling in commercial application of the process, but it is not found in the case of carbonatation molasses.

* * *

Peculiar behaviour of cane juices in respect to high unknown loss. D. R. PARASHAR and M. L. AGARWALA. *Proc. 27th Conv. Sugar Tech. Assoc. India*, 1959, 33–38.—A sudden increase of unknown loss from 0·11–0·2 up to over 0·3 was investigated and shown not to be due to entrainment, loss in condensates, inversion at any stage of the process. Preparation of sucrose balances and examination of samples from neighbouring factories established the high loss as being illusory, caused by the presence of optically active non-sugars.

* * *

Control of seeding operations at the pan floor in a carbonatation factory. T. K. MUKHERJEE. *Proc. 27th Conv. Sugar Tech. Assoc. India*, 1959, 39–44.—The formulae of KELLY and DRINNEN are used for calculation of the amount and size of seed needed for boiling of sugar of required crystal size, using a 4-massecuite system.

* * *

A new technique of preserving neera (date palm juice). N. GOPINATHAN. *Proc. 27th Conv. Sugar Tech. Assoc. India*, 1959, 45–50.—The juice is preserved by adding silica gel which has been used to absorb SO_2. The gas is released slowly and prevents fermentation for at least 18 hours. Gur and sugar prepared from the preserved juice are of superior quality.

* * *

Bacterial inversion in clarified juice in continuous clarifiers during shut-down storages. T. S. RAO. *Proc. 27th Conv. Sugar Tech. Assoc. India*, 1959, 51–54.—Analytical data recorded during a 30-hour shutdown are tabulated. They indicate the slow deterioration of the juice, which is attributed to microbial action.

* * *

A practical remedy to offset the damage done by mirroring or skimming effect in low speed centrifugals purging final massecuites. H. N. MANJAIAH and P. B. SATSANGI. *Proc. 27th Conv. Sugar Tech. Assoc. India*, 1959, 120–123.—The mirroring effect is the retention of molasses in a centrifugal basket where, as a result of dilution or aeration combined with high viscosity, its relative density is less than that of the sugar crystals and the low speed (and low gravity factor) are not adequate to force it out through the basket. At the author's factory this trouble arose through aeration of massecuite and a panel of the discharge chute was arranged so that it could be tilted inwards and acted as a deflecting plate to collect the molasses held at the surface by centri-

[1] SPENCER & MEADE: Cane Sugar Handbook. 8th Edn. (Wiley: New York.) 1945. p. 148.
[2] *I.S.J.*, 1959, **61**, 176.

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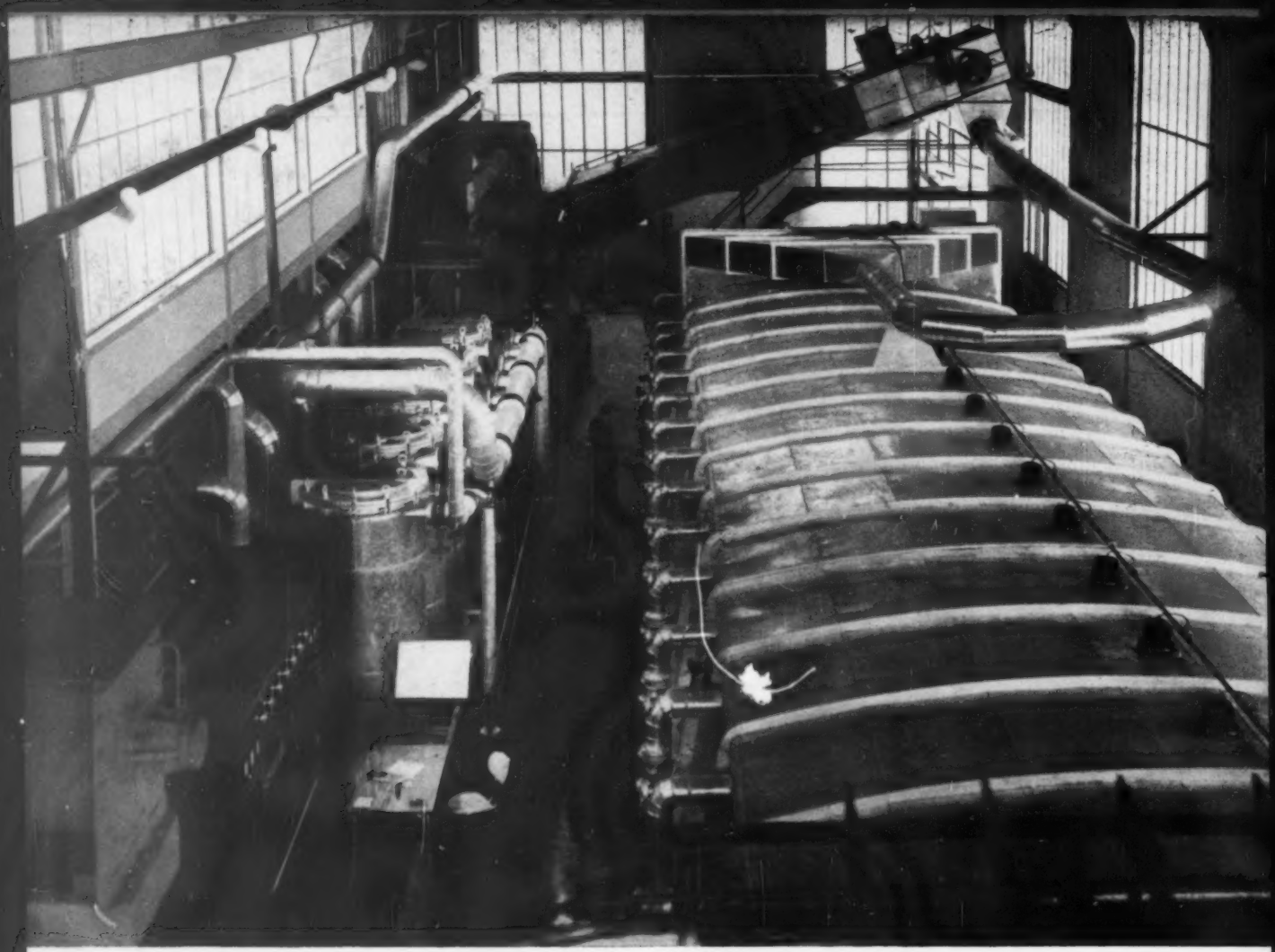

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petal force. The molasses was deflected to a separate gutter and its crystal content recovered by passing to another centrifugal during the acceleration.

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Studies on comparative efficiencies of commercial antiscaling agents in dissolving evaporator scale. N. A. RAMAIAH and S. K. D. AGARWAL. *Proc. 27th Conv. Sugar Tech. Assoc. India*, 1959, 130–134.—Five commercial anti-scale agents, sold under proprietary names, were tested by boiling samples of 1st, 2nd, 3rd and 4th effect scales with 1% solutions during 3–4 hr. The loss in weight and analysis of the residual scales are tabulated as are the initial analyses. From a table of comparative efficiencies it is concluded that "Versene" (EDTA) is the best.

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Weighment of bagasse in cane sugar factories. S. L. PHANSALKAR, H. C. BHATTACHARYA and I. S. JUNEJA. *Proc. 27th Conv. Sugar Tech. Assoc. India*, 1959, 135–140.—See *I.S.J.*, 1961, **63**, 114.

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Storage of sugar in silos. S. L. PHANSALKAR, N. A. RAMAIAH and J. K. P. AGARWAL. *Proc. 27th Conv. Sugar Tech. Assoc. India*, 1959, 141–143.—A brief review of bulk storage and comparison of costs indicate that storage in silos is more economical than in godowns.

* * *

Sugar loss in molasses in Indian sugar factories. S. N. G. RAO, S. L. PHANSALKAR and H. C. BHATTACHARYA. *Proc. 27th Conv. Sugar Tech. Assoc. India*, 1959, 157–173.—A survey of sugar losses in molasses in Indian sugar factories is made. Examination by staff of the National Sugar Institute has shown that in many cases the high losses are due to the following obvious causes which may be readily remedied by the factories themselves, including low concentration, inadequate and inefficient equipment and lack of instrumentation, unsuitable boiling techniques, steam shortage and pressure fluctuation and low vacuum, and high purity of final massecuite. High molasses losses due to the composition of the non-sugars require special study.

* * *

Problems of water economy in sugar factories. A. P. PARKHOMETS. *Sakhar. Prom.*, 1960, (11), 46–53.—A detailed water balance is calculated for a refinery. Tables are given of the properties of the water from various sources and of the maximum consumption as % on weight of refined sugar. The figures show that pond and river water constitutes 1990–2885% weight on refined sugar, cold water consumption is 185–275% on weight of refined sugar and waste waters 1965–2985%.

Vacuum and condensation equipment in sugar factories. B. N. PANDEY. *Indian Sugar*, 1960, **10**, 401–411.—The basic requirements of vapour condensation during boiling and the various types of condensers are described. Also included are the dimensions of a condenser, its efficiency, jet condensing, and vacuum pumps. Calculation of the capacity of a vacuum pump is discussed and a worked example presented.

* * *

A continuous sugar centrifugal. F. PRICE. *J. Amer. Soc. Sugar Beet Tech.*, 1960, **11**, 243–251.—The Hein Lehmann continuous centrifugal is described and particularly modifications to the standard machine made by Silver Engineering Works under licence. Results of tests are tabulated and compared with those obtained with batch machines. Generally, while the continuous centrifugals will give as good as or better results than old and poorly operated machines, well-operated machines will produce sugar of slightly higher purity. However, the continuous machines require no supervision, have low power consumption and maintenance costs, and low initial costs.

* * *

Mill Technology. J. H. NICKLIN and L. R. BRAIN. *Bureau of Sugar Expt. Sta. Ann. Rpt.*, 1960, 91–102.—Investigations were carried out into the velocity of circulation in Webre pans used to boil *C*-massecuites. It was found that there was little variation in the circulation rate from the inside to the outside tubes of the calandria but the rates near the steam inlet were higher at 7·3 in/sec, compared with 6·4 in/sec elsewhere. Three types of impeller made of glass fibre were tested with molasses; at the optimum position in the centre well, the mixed flow impeller was better than the Webre or the axial flow impeller. The position of the Webre impeller was found to be critical, and its efficiency increased at higher speeds. A full-scale impeller is to be designed based on the mixed flow model. In a pan working with natural circulation, the average velocity in the inner tubes was about 50% higher than in the outer tubes, possibly as a result of partial blanketing of the outer tubes by incondensable gases on the opposite side of the calandria from the steam inlet, causing low heat transfer and consequently reduced velocities. The circulation in the Webre pan was better than in the natural circulation (Stewart) pan, although the lowest rate in the former at 2 in/sec was lower than the lowest in the Stewart pan (2·6 and 2·4 in/sec for *A* and *B* boilings respectively). Juice retention time in a Bach subsider was studied with radio-bromine (^{82}Br) introduced into the flash tank. It was found that while the theoretical retention time was 1½ hr, labelled juice appeared at the outlet in 5–10 min and extensive mixing of juices occurred during subsidation. Low density bagasse board has been made by Monsanto Chemical Co. and is suitable for corestock in the manufacture of veneered panels. Details are given of factory performances during the 1959 season.

The effect of centrifugal pumps on 1st carbonatation juice muds. F. N. DOBRONRAVOV and Z. D. ZHURAVLEVA. *Sakhar. Prom.*, 1960, (11), 12–15.—Results of tests carried out to determine the effect of centrifugal pumps on 1st carbonatation juice or muds returned to predefecation are discussed. Clarifier muds were fed to a tank, pumped to another tank, then either filtered together with fresh clarifier muds or recirculated between the two tanks. The s.g. of the original muds and pumped muds was determined, as well as the time of filtration of 50 ml at 1 atm pressure and under a vacuum of 300 ml Hg. The filtered 1st and 2nd carbonatation juices were also analysed. At an s.g. of the original muds of 1·05–1·09 there was little damage to the particles, the filtration rates decreasing (less under pressure than under vacuum) only after the 3rd recirculation. The settling rate fell only very slightly. Most of the juice properties did not change. However, the lime salts content of 2nd carbonatation juice increased with the number of circulations, e.g. from 0·298% CaO on solids in the original muds to 0·362% after the 4th circulation. With increase in the s.g. above 1·10 and in the number of circulations, the 1st carbonatation juice quality fell and the particles were broken up. Increase in the Ca salts content is attributed to separation of the colloidal particles from crystals of $CaCO_3$ and their amalgamation with CaO. The number of circulations should be reduced to a minimum and centrifugal pumps should not be used. A tank for all the clarifier muds in a factory is recommended with a screw at the bottom to prevent settling of the sediment. The suspension should be sent direct to the vacuum filters and any excess returned to the tank. Centrifugal pumps should be replaced with reciprocating pumps.

* * *

Sixteen-frame centrifugal beet slicer. V. I. FOKIN. *Sakhar. Prom.*, 1960, (11), 24–25.—Details are given of an electrically-operated slicer of Soviet design which has a slicing rate of 150 tons/day (flat cossettes) or 2100 tons/day (grooved cossettes). It holds 16 knife frames, any of which are capable of being removed from the drum without stopping the slicer.

* * *

The reduced length of cossettes and calculations of the diffusion surface. A. K. BURYMA. *Sakhar. Prom.*, 1960, (11), 25–29.—In evaluation of beet cossettes in terms of the length per 100 g, the heterogeneity of the cossette and the effect of the beet knives on the diffusion surface are not taken into consideration. Formulae are derived for calculation of the so-called "reduced" length of the cossette and for the calculation of the ratio of diffusion surface:cossette thickness for any given cossette length and beet knife cutting edge. Tables are given of values of the various factors for different knives, but unfortunately the worked examples refer to values which are beyond the range of the tables. A formula derived by OPLATKA for calculation of the cossette thickness if the cossette is sufficiently homogeneous is shown by comparison to give inaccurate values.

* * *

Power consumption in (Steffen) separation plants. N. R. FREPON. *Sakhar. Prom.*, 1960, (11), 30–36.—The power consumptions in the Steffen plant of Ertil'sk and Zherdevsk sugar factories are compared. Each factory has a daily slice of 1800 tons of beet and the separation plants process 60 tons of molasses daily. The consumption at Ertil'sk is 179 kW, compared with 283 kW at Zherdevsk, largely because of higher vacuum pump and compressor capacity at the latter. Details are given of each piece of equipment and of its energy requirements.

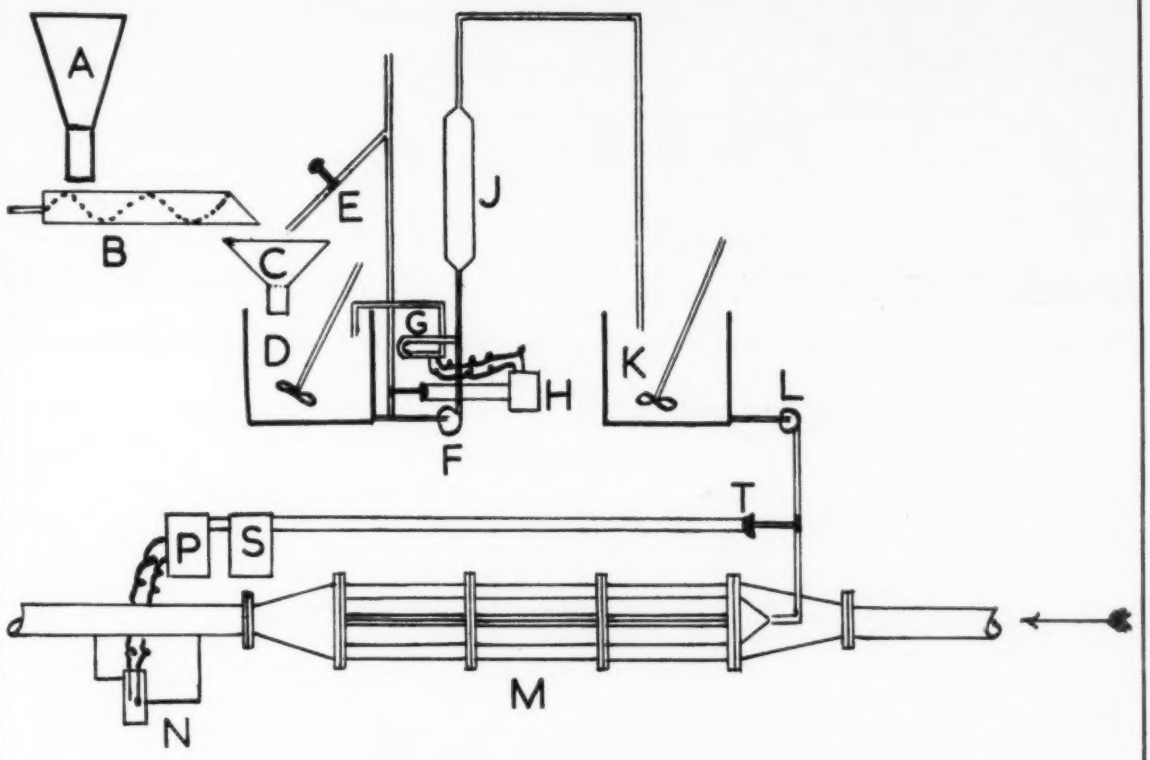
* * *

Remote control at the Lenin sugar factory by means of a beet gate valve. E. S. ZAKREVSKII. *Sakhar. Prom.*, 1960, (11), 37–38.—A semi-automatic control system for beet feed to the knives is described. The operator wishing to reduce or increase beet flow, turns a switch which raises or lowers the gate at the beet flume. A scale on the main instrument indicates the position of the gate as percent opened.

* * *

The occurrence and elimination of saponin in process juice. J. R. JOHNSON. *J. Amer. Soc. Sugar Beet Tech.*, 1960, **11**, 201–205.—Tests carried out on the control of saponin are discussed. Reduction of battery diffuser water pH to 6·0–6·5 did not significantly reduce the saponin content of process liquors or granulated sugar. Reducing the pH of standard liquor to 5·0–5·5 with SO_2 precipitated some saponin, which was removed by filtration. The pH of the filtrate was adjusted to 7·0 with NaOH, followed by filtration and pan boiling, but the process did not remove sufficient saponin from the standard liquor to prevent co-precipitation or crystallization of the saponin in white sugar pans. Adding milk-of-lime (0·25% on beet) at 2nd carbonatation removed only a small amount of saponin. Pre-defecation may, according to laboratory experiments, prove more successful. Maintenance of a pH of 8·0 in a white sugar pan using NaOH helps to reduce the saponin content to less than 60 p.p.m. as found by GADDIE[1]. However, at a saponin content of 175 p.p.m. in thick juice, the content in the sugar may rise to at least 5 p.p.m. even when boiled from syrups of pH 8·5.

[1] *I.S.J.*, 1959, **61**, 280.



AUTOMATIC LIMING CONTROL

KEY TO SCHEMATIC DRAWING LAYOUT

A—Hydrated Lime Hopper

B—Screw Conveyor

C—Sieve-bottom Receiver Hopper.

D—Heavy Milk-of-Lime Tank with Stirrer.

E—Hand Operated Valve on Water Line.

F—Centrifugal Pump for Heavy Milk-of-Lime to Density Meter & Controls.

G—Density Meter, Continuous and Automatic.

H—Recorder/Controller for Continuous Density Control.

J—Stand-pipe for ensuring that Meter is always full.

K—"Correct" Milk-of-Lime Tank, with Stirrer.

L—Centrifugal Pump for "Correct" Milk-of-Lime to Process.

M—Mixer Unit.* (Patent Pending).

N—Flow-through Electrode System for pH Control.

P—pH Transmitter.

S—Recorder/Controller for pH Control of Liming.

T—Automatic Valve for Controlled Addition of "Correct" Milk-of-Lime to Mixer unit.

* See *I.S.J.*, 1958, **60**, 213.

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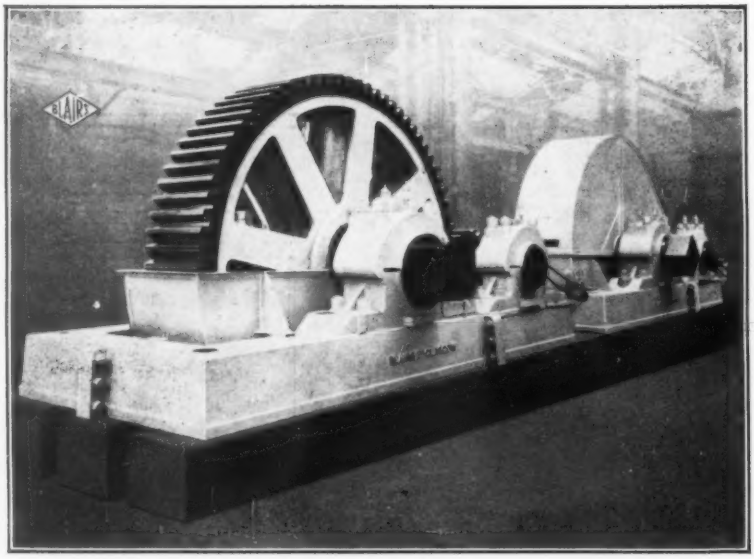

This illustration shows the second motion gearing for driving Sugar Cane Crushing Mills. These Cast Steel Spur Wheels and Pinions are carried on Mild Steel Shafts, supported on Gunmetal-bushed Cast Iron Bearing Blocks. The Gears are fitted with oil-tight and dust-proof covers.

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Compositional changes in diffusion juices from stored sugar beets. H. G. WALKER, E. S. OREM and R. M. MCCREADY. *J. Amer. Soc. Sugar Beet Tech.*, 1960, **11**, 206–214.—Beets were washed, dipped in a fungicide solution and divided into 10 samples before packing in modified steel drums (two samples per drum). The drums were covered and water-saturated air slowly passed through to maintain humidity and ensure oxygen for respiration. Three drums were stored outdoors, at an average daily temperature of 150°F, while two were stored at a constant temperature of 34°F. Further samples were stored without fungicide treatment at 71°F. Analysis of raw juice from the beets shows a more rapid decrease in pol, RDS and purity at ambient than in a cooler environment. Purity tends to decrease with the length of the storage time. The reducing sugar content increases as a result of normal metabolic changes in healthy tissue and not as a result of spoilage. The total sugar percentage remains reasonably constant. Analysis of other constituents showed no other clearly-defined trend. Cold storage appears to promote an undesirable accumulation of raffinose.

* * *

The dependence of filtration on the amount of recirculating 1st carbonatation juice, alkalinity and on the layer of muds. K. D. ZHURA. *Trudy Kiev. Tekhnol. Inst. Pishch. Prom.*, 1960, **22**, 16–20.—Laboratory and factory tests on 1st carbonatation juice filtration are discussed. In the first tests 50–300% unfiltered 1st carbonatation juice was returned to the raw juice. Increase in the amount of returned juice increased the filtration rate, but also slightly increased the colour. However, the effect of recirculation is reduced as the pectin content of the juice increases. A final alkalinity of between 0·03 and 0·08%CaO caused only a very slight drop in the filtration rate, while increase to 0·15% CaO caused a sharp fall in the values of F_k. A pure sugar solution, juice with recirculated juice added (1:1) and raw juice were filtered after liming and carbonatation. The pure sugar solution occupied a position intermediate between the other two juices on a graph of filtration rate *vs.* mud thickness; this indicates that, as organic colloids are absent in the cake, the distribution and size of $CaCO_3$ particles in the muds also affect the filtration rate. Increasing the cake thickness above 10 mm reduces the filtration rate, and 7–10 mm is recommended for vacuum filters.

* * *

Effect of pectic substances and the products of their alkaline decomposition on molasses coefficients of saturation. I. A. PRIKHOD'KO. *Trudy Kiev. Tekhnol. Inst. Pishch. Prom.*, 1960, **22**, 29–34.—Molasses solutions were kept at 50°C in a thermostat during five days in the presence of added sucrose (10 g per 50 g molasses). It was found that addition of pectic substances at up to double the amount normally passing into raw juice did not have any appreciable effect on the saturation coefficients, e.g. at 50°C the coefficient was 1·567 without pectin addition, and with pectin added it averaged 1·575 with a maximum of 1·663 and a minimum of 1·523. The molasses coefficient was increased by 0·018–0·18 units, the latter when only the products of alkaline decomposition of sucrose were added. Pectins and their alkaline-decomposition products are melassegenic and should be removed as much as possible.

* * *

The temperature field across a (vacuum pan) tube during boiling of green syrup. V. T. GARYAZHA. *Trudy Kiev. Tekhnol. Inst. Pishch. Prom.*, 1960, **22**, 35–39.—A study was made of changes in the temperature of a massecuite across a special single-tube evaporator. Heating is by means of conducting wires wound round the tube which is divided into three lengths of 170 mm, so that 170 mm, 340 mm or 510 mm of the tube may be heated at one time. Opposite the point at which the current is fed to each length, there are three pipe sections connecting to a common circulation tube. The wall and massecuite temperatures are measured by thermo-couples to an accuracy of 0·1°. The green syrup concentration was 75–80·1–83% solids content and the purity 79·2. Overheating of the solution at the tube wall increased with concentration and the form of the temperature curve across the tube depended on the rate of circulation. At a certain distance from the wall the curve had a hump, which became more pronounced with increase in concentration.

* * *

Equipment of a plant using continuous sugar crystallization without massecuite boiling. I. S. GULYI and V. D. POPOV. *Trudy Kiev. Tekhnol. Inst. Pishch. Prom.*, 1960, **22**, 48–55.—A scheme of evaporation and crystallization without massecuite boiling is described, whereby a 65% concentration mixture of thick juice and wash syrup is thickened to 83–84° Brix in the 1st evaporator, and at 95°C send direct to the crystallizer for cooling to 30–35°C. The run-off from the centrifugals is evaporated in the 2nd evaporator from 70 to 84–85° Bx, crystallized and spun, the resultant run-off being evaporated in the 3rd evaporator to 86°Bx, crystallized and spun. The 3rd run-off is evaporated in the 4th evaporator to 88°Bx before crystallizing and spinning. White sugar is obtained from the first two evaporators, yellow sugar from the other two. For crystallization, a special rotating continuous crystallizer is advocated[1] in which the massecuite is cooled from 95° to 30–40°C by a counter-current of water flowing through a series of coils. Details and diagrams are given of this equipment.

* * *

Analysis of wear of certain parts of beet factory equipment. G. A. PREIS and N. A. SOLOGUB. *Trudy Kiev. Tekhnol. Inst. Pishch. Prom.*, 1960, **22**, 56–68.—An investigation into causes of wear in certain machinery parts has shown that: cast iron bearing bushes will reduce wear of both bushes and journals in comparison with bronze or Babbitt metal. For the beet washer, the bushes should be of perlite iron,

[1] U.S.S.R. Patent 102,472.

and replaceable steel or iron sleeves should be used. The beet elevator crank pins, the wear of which depends on their hardness, should be annealed and case-hardened to increase protection. Water lubrication at a pressure of 1·5 atm should be used to remove abrasive particles from beet washer bearings.

* * *

New experience with centrifugal pumps in sugar factories. R. ISSELHARD. *Zucker*, 1960, **13**, 599–604.—An illustrated review is given of centrifugal pumps, and particularly the special modifications as used in sugar factories (beet and cossette pumps and special pumps for diffusion). A new type of propeller pump designed by the author in co-operation with E. LANGE is intended for general use in sugar factories.

* * *

Automatic dosing in the determination of sugar in sugar beet. A. J. VAN DUUREN. *Zucker*, 1960, **13**, 604–605.—See *I.S.J.*, 1961, **63**, 61.

* * *

Transport, cleaning and storage of sugar beet. K. BAGERT. *Zeitsch. Zuckerind.*, 1960, **85**, 631–636.—Problems associated with the transporting, cleaning and storage of beet are discussed and equipment described and illustrated (in particular, that of Elfa-Apparate-Vertriebs-G.m.b.H.). Recommendations are offered on the question of cleaning and ventilation of beet piles and results of tests are reported.

* * *

Sand removal from milk-of-lime with a rotary classifier. H. FIEDLER. *Zuckererzeugung*, 1960, **4**, 368–369.—A rotary classifier built by VEB Maschinenfabrik Sangerhausen is described and illustrated. The machine works on the settler principle, the sand being removed on a belt onto which it drops and which does not disturb the milk-of-lime while it is rotating within the classifier casing. The classifier is recommended for coarse sand removal before hydrocyclone treatment.

* * *

Technological and mathematical comparison of different sugar-house schemes. H. MÜLLER. *Zuckererzeugung Beilage*, 1960, (2), 8–18.—Fourteen boiling schemes are compared using the methods of CECIL[1]. On the basis of highest sugar quality, lowest quantity of massecuite and lowest steam requirements for boiling, a 3-boiling scheme is recommended in which *C* raw sugar is mixed with a *B* run-off and spun with *B*-massecuite without washing. The raw sugar in the *B* centrifugals is mixed with *A* raw syrup and again spun, this time being washed with water.

* * *

Decolorizing ion exchangers. XII. Factory tests on decolorizing of refinery syrups. V. VALTER, Z. MENCL, K. ČIŽ and J. ŠTAMBERG. *Listy Cukr.*, 1960, **76**, 265–272.—Pilot-plant tests in which "Wofatit E" (now designated "Wofatit EW"), "5A", "1A" and "Decolorex A 2" were used to decolorize refinery syrups are discussed. Each of 4 columns contained about 1·5 cu.m. resin and 11,470 cu.m. of syrup was treated during 2 campaigns. High alkalinity of the syrup was unfavourable, the decolorizing effect of the ion exchangers falling with rise in the pH. "Wofatit E" and "1A" were more sensitive than the others to pH rise. The pH should be about 7·8–8·3, and certainly no greater than 9. During the first 8–10 cycles the decolorizing effect dropped by about 45–50%, then remained almost constant. An average of 108 volumes of syrup were decolorized per volume of resin at 80°C. The average specific loading was 0·7 hr^{-1}. The average colour of treated and untreated syrup was 0·82°St. and 2·45°St. respectively, at a Brix of 64°. Average colour adsorption efficiency over 20 cycles (2160 cu.m. syrup) using the "Wofatit" resin was 61%. Average decolorizing efficiency for the resins throughout the two campaigns was from 58% ("Decolorex") to 66% ("Wofatit"). After a sufficient number of cycles to bring the quantity of adsorbed colouring substances to the same level, the "Decolorex" and "Wofatit" resins had almost the same decolorizing properties, based on the equivalent bed heights. With correct regeneration, no increase in the invert sugar content was observed.

* * *

The problem of air conditioning sugar silos. K. ČIŽ. *Listy Cukr.*, 1960, **76**, 272–274.—Equations for calculation of the resistance to air flow of a layer of sugar of varying grain sizes are presented. The values obtained using BARTH's formula[2] are lower than the determined values, expressed as mm Hg. The difference between the determined values and those obtained by means of ERGUN's formula[3] increased with decrease in grain size, indicating the significance of grain size in silo storage.

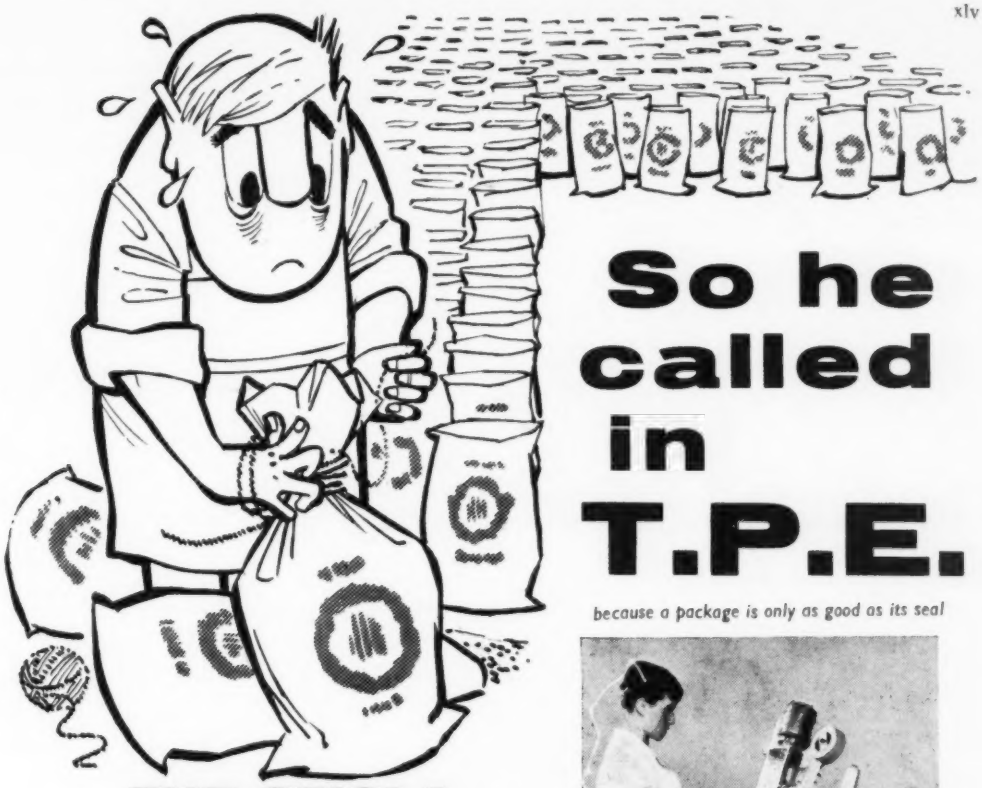
* * *

The rôle of pectins in sugar manufacture. I. A. VIGH. *Cukoripar*, 1960, **13**, 324–328.—A general review with 45 references to the literature of the various pectin substances with details of their optical properties and chemical composition.

* * *

Theoretical bases of automation of massecuite charging into a centrifugal basket. K. A. BORTNOVSKII. *Izv. Vysshikh Ucheb. Zaved. Pishch. Tekhnol.*, 1959, (6), 95–100.—Theoretical formulae are derived for calculation of the optimum speed of a centrifugal basket during massecuite charging, i.e. that angular velocity at which the centrifugal force is sufficient to throw the massecuite onto the wall of the basket but not so high that intercrystalline molasses separation will reduce the fluidity of the massecuite. A graph is presented of the optimum time of charging *vs.* the angular velocity of the basket at various values of excess momentum of the drive (moment of the centrifugal drive-moment of inertia during charging). Other factors affecting charging (rate of massecuite flow from the mixer, centrifugal dimensions, the dynamics of its motion, drive characteristics) are not dealt with.

[1] *Zeitsch Zuckerind.*, 1951, (9), 1952, (2, 3, 5).
[2] *Chem. Ing. Tech.*, 1951, **23**, 389.
[3] *Chem. Eng. Progr.*, 1952, **48**, 89.



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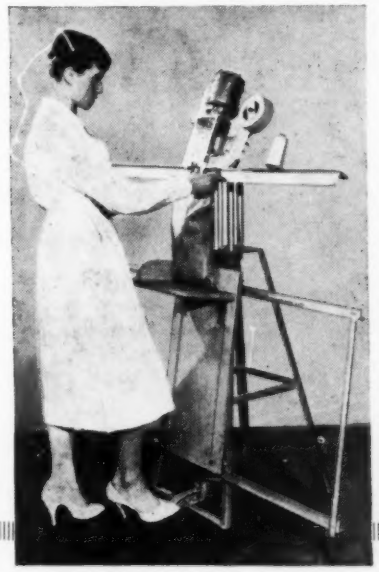

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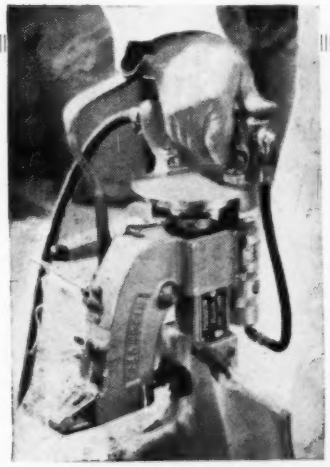

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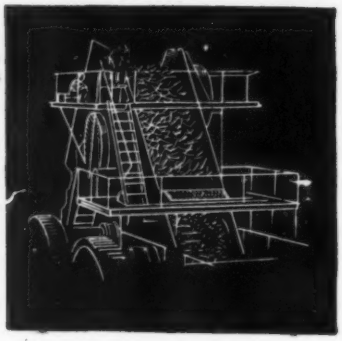

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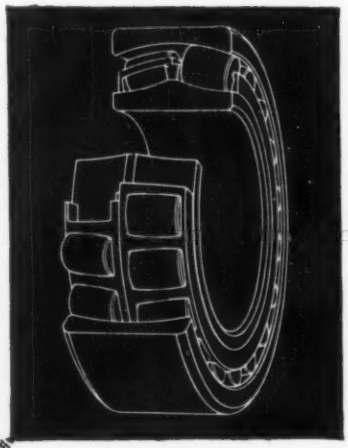

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Waste or Wealth? 27 pp; 5¼ × 8¼ in. (Dept. of Scientific and Industrial Research, 14–18 Cornwall Terrace, London N.W.1.) 1960.

This small booklet reviews some of the ways in which apparently unpromising waste materials from one industry have found valuable outlets in others. Investigation of this sort of waste product utilization is one of the functions of the Department and associated Government research organizations, and examples of some of the successful applications of waste products and others under investigation are recorded. These include the manufacture of cement and bricks from pulverized fuel ash, animal feeds from distillery wastes, etc., and a brief account is given of the work done by the Sugar Technology Laboratory in Trinidad and the Tropical Products Institute on the ammoniation of molasses for animal feeds, cane wax recovery and purification, bagasse board manufacture and production of detergents from sucrose.

* * *

Weed Control. Ed. E. K. WOODFORD. 264 pp.; 5½ × 8½ in. (British Weed Control Council; Blackwell Scientific Publications, Oxford.) 1960. Price: 17s. 6d.

A new revised edition of this work, which first appeared in book form in 1958, has become necessary. This is not surprising considering the numerous and very rapid advances in chemical weed control that have taken place in the last two years. The book is intended for all those interested in either the practical or technical aspects of chemical weed control. In addition to dealing with established herbicides or weed killers it supplies information on those weed killers still more or less in the experimental stage, with accounts of their chemistry, their effects and recommended doses. A large range of weeds and crops are covered including sugar beet. Sugar cane is not specifically mentioned. However, the book is likely to be of interest or value to those concerned with the technical aspects of weed control in sugar cane. What makes the book somewhat unique is that the principal interested commercial and official bodies have been brought together to produce an agreed statement.

* * *

Ministry of Agriculture and Lands, Jamaica. Annual Report 1958. 92 pp; 7¼ × 9¾ in. (Government Printer, Kingston, Jamaica, W.I.) Price: 4s 0d.

The technical reports on sugar cane are published elsewhere and the brief references to this crop contain the following information. The Island's production of sugar was the lowest for six years, a result attributed to a succession of droughts, accompanied by a low sugar content. Noteworthy, too, is the proportionate increase over the previous 20 years of the cane supplied by cane farmers. If this means a wider distribution of income derived from cane, it also involves a proportionate decrease in the tonnage of cane from a given area, for the respective yields of sugar for estates and cane farmers are 3·08 tons/acre and 1·50 tons/acre respectively.

* * *

Przemysl Cukrowniczy w Swietle Liczb 1955-1958. (Sugar Industry Statistics 1955-1958.) J. JANOTTA, E. LACHOWICZ and B. TOMCZYŃSKI. (In Polish.) 134 pp; 5¾ × 8 in. (Gazeta Cukrownicza, Warszawa 1, Czackiego 3/5, Skrytka poczt. 360, Poland.) 1960. Price: 30 złoty.

This is No. 4 in the "Library" series of paper-backed editions issued by the publishers of *Gazeta Cukrownicza* and is a detailed statistical survey of the world and Polish sugar industries for 1955–1958. It is complementary to No. 2 in the series, which convered the period 1950–55[1]. Twenty-four pages are devoted to the world industry and the most important sugar-producing countries and the remainder of the book to the Polish industry. The extreme detail with which the book is compiled makes it very useful, albeit principally to those with knowledge of Polish, although much information may be gleaned by consulting the dictionary for only a very few words.

* * *

The Australian Sugar Year Book, 1961. 520 pp; 7¼ × 9¾ in. (Strand Press Pty. Ltd., 236 Elizabeth Street, Brisbane, Queensland, Australia.) 1961. Price: 30s 0d.

This edition follows the lines of last year's edition, opening with the "Sugar Year Digest". Articles include one by H. W. KERR on ten years' progress in milling and manufacture, a brief survey of the Queensland industry by the late R. J. S. MUIR, an article by J. SOUTHGATE (Commonwealth Sugar Exporters London liaison officer) on sugar export marketing, and an agricultural paper by N. J. KING entitled "Leaf Desiccant in Mechanical Harvesting". Other papers cover factory control, crushing research, and the work of the Bureau of Sugar Experiment Stations. Association reports precede the body of the work—the usual and useful comprehensive details on the mills and districts brought up to date for the new edition.

[1] *See I.S.J.*, 1958, **60**, 371.

LABORATORY METHODS AND CHEMICAL REPORTS

Practical non-sugar calculations as a guide to the functioning of the factory. M. G. HARTLEY. *La Ind. Azucarera*, 1960, **66**, 363–365.—Calculations of the quantities of non-sugars in molasses and sugar are developed, based on the measurement of total mixed juice and filter cake, and analyses of the mixed juice, filter cake, clear juice, molasses and sugar. Application of these calculations to general factory control based on Brix, sucrose and non-sugar balances, control of non-sugar elimination in clarification, of inversion, and non-sugar circulation in the pans, are discussed briefly.

* * *

Determination of chloride in white sugar solutions. G. MANTOVANI. *Ind. Sacc. Ital.*, 1960, **53**, 131–138.—Solutions of KCl in conductivity water, containing 0, 10 and 30% of sucrose (white sugar recrystallized to 0·032% ash and 0·007% invert sugar from conductivity water solution) were titrated with silver nitrate using sodium chromate, fluorescein, and dichlorofluorescein as indicators [N/10, N/50 and N/100 KCl] and by a potentiometric technique [N/50 and N/400 KCl]. Results are given in tables showing maximum, mean and systematic errors for the various concentrations of KCl and sucrose and the various analytical techniques. Except in the case of potentiometric titration of N/400 KCl, the presence of sucrose increased the error, while the error was higher at lower KCl concentrations than at higher.

* * *

Storage of refined sugar. K. ČIŽ and J. NACHÁZELOVÁ. *Listy Cukr.*, 1960, **76**, 246–249.—Experiments were carried out on refined sugar to determine the relationship between ash content, grain size, moisture content and R.H. during storage. The cations present in the ash were determined by ion exchange and flame photometry. Graphs are presented for three grain sizes (1·6, 2·4 and 2·9 sq.mm.) showing the relationship between ash content and R.H. at different values of crystal moisture content. These indicate a reduction in hygroscopicity with a reduction in grain size and an increase in the ash content. A nomogram is presented showing the relationship between grain size at 0·016–0·029 sq.cm. and moisture content (20–300 mg %) at different values of R.H. and an ash content of 5–25 mg %.

* * *

The present state of development of laboratory apparatus. W. STRUBE. *Zuckererzeugung*, 1960, **4**, 302–306, 336–338.—The instruments covered in this review include balances, polarimeters, refractometers, colorimeters, pH meters and viscometers. The latest principles and designs are discussed with numerous photographs and diagrams of a number of well-known makes.

Raw juice extraction in the laboratory for determination of the technical value of the sugar beet. C. J. ASSELBERGS, P. W. VAN DER POEL, M. L. A. VERHAART and N. H. M. DE VISSER. *Zucker*, 1960, **13**, 574–578.—The laboratory-scale counter-current extractor described earlier[1] is discussed and details of test results are reported. Data demonstrate the reproducibility of the results and the use of the apparatus to evaluate beet of different varieties and from different soils is indicated. Nitrogen addition to the growing beet at 200 kg N/ha resulted in a somewhat higher K + Na content of the raw juice (21·9 + 1·3 compared with 18·5 + 1·2 meq/100 pol in the juice from untreated beet) and this caused a 20% increase in the molasses yield. Beet from marshy soils yielded better quality raw and 1st carbonatation juices than beet grown in sandy soils, in agreement with factory experience during 1959.

* * *

Fibre % cane: analysis and effect on chemical control. C. B. RAYMOND. *Sugar News* (Philippines), 1960, **36**, 457–459.—Calculations are presented to demonstrate how analysis of % fibre in clean cane only instead of % fibre in gross cane will give differences of about 4% pol in bagasse, of 0·26% in the pol Java ratio, of 0·28% in sucrose extraction, and 0·28% sucrose losses in bagasse, based on the sucrose content of the cane.

* * *

A new method of investigating the enzymatic inversion of sucrose. B. ANDERSEN and T. A. BAK. *Acta Chem. Scand.*, 1960, **17**, 823–828; through *S.I.A.*, 1960, **22**, Abs. 1011.—The optical rotation of a sucrose solution which is enzymatically inverted can be measured directly. The correction to be applied for the mutarotation is derived as a second order differential equation which is solved numerically by a step-by-step integration. The disagreement between the calculated and the experimental values of the degree of reaction was only slightly higher than the experimental uncertainty. With the mutarotation constants for glucose and fructose thus determined (0·02473 min^{-1} and 0·2750 min^{-1} respectively), a value of —70·8° for the optical rotation of β-fructofuranose was found.

* * *

Analysis of the diluted saturation mud in (beet) sugar factories. I. VAVRA and A. VAVRA. *Kemija u Industriji*, 1960, **9**, 33–42; through *S.I.A.*, 1960, **22**, Abs. 1021.—The usual standard method for determining the sugar in saturation mud has certain drawbacks. The mud analysed immediately after leaving the filter press does not have the expected composition, and it is not possible to obtain a good average sample directly from the presses. It is therefore better to analyse the diluted mud before discharge from the factory, since the mass has then become well mixed,

[1] *I.S.J.*, 1960, **62**, 95–97.

and losses by outflow of juice are included. A proposed new standard analytical method is described in detail.

* * *

Determination of sugars and related compounds on glass fibre paper. G. JAYME and G. HAHN. *Angew. Chem.*, 1960, **72,** 520–522; through *S.I.A.*, 1960, **22,** Abs. 1022.—Sugars, uronic acids, etc. are separated by chromatography on glass fibre paper (purified and impregnated with a buffer mixture at pH 5·0 for sugars, pH 7·5 for uronic acids). The positions of the compounds on the chromatogram are indicated by spots on outer strips sprayed with aniline phthalate. The parts of the chromatogram thus indicated are cut out and heated in a small flask on a water bath with a sufficient quantity of a potassium dichromate solution from a microburette. After cooling, the contents are transferred to a beaker, 5 ml of a potassium iodide solution are added and the dichromate is back-titrated with a thiosulphate solution, with starch as indicator. The values obtained are corrected with a blank determination carried out at the same time. The deviations in parallel determinations are less than ~5%.

* * *

Analysis of final molasses for glutamic acid content. V. M. KATS and I. K. IVANOVA. *Sakhar. Prom.*, 1960, (11), 18–23.—Results are given of tests carried out to determine the glutamic acid content of final molasses using a modification of the electrophoretic method of SCHNEIDER *et al.*[1] The samples were collected from different factories. Graphs are also presented demonstrating the effect of ambient temperature and rainfall on the glutamic acid content of molasses during growth of the beet.

* * *

The rôle of nitrites in promoting high ash values in white sugar. K. W. R. SCHOENROCK and J. R. JOHNSON. *J. Amer. Soc. Sugar Beet Tech.*, 1960, **11,** 258–267.—Abnormally high ash contents in the white sugar from a beet factory were found to be due to the formation of potassium imidodisulphonate[2]. Details are given of the analyses. Reference is made to the work of CARRUTHERS *et al.*[3] on the question of nitrite formation as a result of bacterial action, and methods of combating this are reported.

* * *

The effect of certain factors on the degree of precipitation of sucrose by barium hydroxide. L. G. KALINENKO and I. M. LITVAK. *Trudy Kiev. Tekhnol. Inst. Pishch. Prom.*, 1960, **22,** 7–16.—The literature on the barium saccharate process is reviewed with 22 references. Results of laboratory tests are discussed in which hot barium hydroxide suspension was mixed with hot sugar solution at constant temperature, filtered on a Buchner funnel, and the saccharate precipitate washed with baryta water. The wash was added to the filtrate, which was brought to weak alkalinity by saturating with CO_2 at 80–90°C, neutralized with acetic acid, cooled and made up to volume with water. The sugar content was determined and the amount of precipitated sugar calculated. Increasing the settling time from 5 to 25 min had no effect on the sugar yield. Increase of temperature above 75°C had little effect. When 1 mole of barium hydroxide was added to 1 mole sucrose for precipitation from a 30% solution, recovery as saccharate was 87·15%, rising to 98·31% with an excess of 0·4 mole of $Ba(OH)_2$. Increasing the molar ratio of the hydroxide to 2:1 had little further effect. At 75°C the sucrose yield increased with the original sugar concentration at identical settling periods and barium hydroxide ratio (1·4:1), e.g. 97·26% from a 20% solution and 98·33% from a 30% solution.

* * *

Alkaline decomposition of sucrose. L. P. REVA and I. M. LITVAK. *Trudy Kiev. Tekhnol. Inst. Pishch. Prom.*, 1960, **22,** 21–28.—A review of the literature on sucrose decomposition (20 references) reveals a lack of information especially on alkaline decomposition in conditions encountered in the beet factory. The authors consider of great interest in explaining abnormal sucrose losses the effect of individual factors on the degree of decomposition during juice purification, during protracted settling of 1st carbonatation juice and also during evaporation.

* * *

Determination of the physico-chemical temperature depression in vinasse. G. S. DEMCHUK and A. B. DEMCHUK. *Trudy Kiev. Tekhnol. Inst. Pishch. Prom.*, 1960, **22,** 40–42.—Laboratory experiments are discussed, in which a vinasse solution and distilled water were each boiled in flasks in baths of aqueous calcium chloride and the b.p. elevation measured. The vinasse concentration was determined refractometrically. The determined values of the temperature difference (Δ) agree well with values calculated from an empirical formula for concentration at atmospheric pressure, $\Delta = 0{\cdot}0079\ DS^{1{\cdot}7}$, where DS = % dry solids, the maximum error being 0·05°. For pressures other than atmospheric, the temperature difference is given by $\Delta = 0{\cdot}003872\ T^2/r$, where T = absolute b.p. in °K and r = latent heat of evaporation of water at the given pressure in kcal/kg. Again, determined values agree closely with calculated values.

* * *

Physical parameters of vinasse. V. D. POPOV, V. T. GARYAZHA and E. A. YATSENKO. *Trudy Kiev. Tekhnol. Inst. Pishch. Prom.*, 1960, **22,** 43–47.—The s.g. and viscosity of vinasse from a distillery using the hydrochloric acid production method were determined. The s.g. was determined with a pycnometer, the viscosity with a HÖPPLER viscometer. An empirical formula is derived for s.g. (γ), viz. $\gamma = 1020\ e^{0{\cdot}00447\,DS} - 0{\cdot}8\ t$ kg/cu.m., where DS = dry solids, and t = temperature.

[1] *Zucker Beihefte*, 1957, (3), 78–85.
[2] *See I.S.J.*, 1960, **62,** 313–318, 339–343.
[3] *I.S.J.*, 1958, **60,** 113, 335, 376.

This is suitable for approximate values. An empirical formula for viscosity ($\mu = \mu_o e^{-bt}$, where μ_o = nominal viscosity at t = O, and b = function of dry solids concentration) also may be used to give approximate values. Tables of s.g. and viscosity are also recommended for use in heat calculations for vinasse boiling.

* * *

Effect of certain quaternary ammonia compounds on the microflora of molasses. T. P. SLYUSARENKO. *Trudy Kiev. Tekhnol. Inst. Pishch. Prom.*, 1960, **22**, 178–182.—Cetylpyridinium chloride ("Ceepryn") and cetyldimethylbenzyl ammonium bromide ("Ceferol" or "Ceferan") were used in tests as antiseptics. A must of 22% dry solids was used with addition of 1% superphosphate and 0·5% autolysate of yeast. Concentrations of the two quaternary ammonium compounds were 0·0005%–0·03%. Tests were carried out in alkaline conditions and acid (with HCl acidification). The substances were effective as antiseptics. At 0·0075% the "Ceferol" retarded yeast formation somewhat at the start, the yeast sensitivity being greater than with the "Ceepryn". Weak fermenting of the must occurred at 0·005–0·1% "Ceepryn". Yeast accumulation was slower at 0·0025% than without antiseptics. At 0·001% fermentation was normal. After 17–19 days the yeasts adapt themselves to "Ceepryn".

* * *

Improved colorimetric method for determining ferrocyanide ion, and its application to molasses. J. R. MARIER and D. S. CLARK. *Analyst*, 1960, **85**, 574–579.—An aliquot (≯ 5 ml) of sample solution, diluted standard solution [5 to 80 μg of $Fe(CN)_6^{4-}$] or water (blank) is placed in a colorimeter tube, its volume is adjusted to 5 ml, 2 ml of 50% citric acid solution is added and then 1 ml of $FeCl_3$ solution (0·6% w/v in 0·1N HCl). After 60 to 90 min at room temperature, the extinction is measured at 690 mμ. To correct for the colour of molasses, a duplicate aliquot of sample is treated similarly, but with 1 ml of water replacing the $FeCl_3$ solution. The extinction measured against a normally prepared reagent blank, is deducted from that of the test solution. When the method is used for the determination of residual $Fe(CN)_6^{4-}$ in beet molasses the presence of up to 3 ml of diluted molasses (25% dilution) has no adverse effect. The results of recovery experiments averaged 100·3 ± 3·2% and were not significantly affected if the sample had undergone fermentation treatment.

* * *

A simple method for estimation of calcium in sugarhouse products using ethylene diamine tetraacetic acid. N. A. RAMAIAH, –. VISHNU and R. K. CHATURVEDI. *Proc. 27th Conv. Sugar Tech. Assoc. India*, 1959, 124–126.—See *I.S.J.*, 1959, **61**, 184.

* * *

Studies on the formation of sugar-salt melassegenic complexes. N. A. RAMAIAH and –. VISHNU. *Proc. 27th Conv. Sugar Tech. Assoc. India*, 1959, 127–129.—Cf. *I.S.J.*, 1960, **62**, 24, 74.

Number and size of crystals in seed slurry and massecuite. S. L. PHANSALKAR, H. C. BHATTACHARYA and M. U. OAVISI. *Proc. 27th Conv. Sugar Tech. Assoc. India*, 1959, 152–156.—Reference is made to the importance of control of boiling by development of crystals from a number of grains in the footing. A description is given of a method for counting and measuring the size of crystals deposited on a 19 × 16 mm area of a 3 × 2 in slide from a fondant slurry and from a massecuite, using a microscope fitted with a graticule.

* * *

Determination of average equivalent weight of plant acids by ion exchange resins applied to sugar beet molasses. J. B. STARK. *J. Agric. Food Chem.*, 1960, **8**, 234–236; through *J. Sci. Food Agric. Abs.*, 1960, **11**, ii–266.—A method is described for separating anions from plant extracts by passing them though columns of "Dowex 50". CO_2-free water is used for diluting samples and washing solutions through the columns. The method was used on sugar beet molasses, the acids of which had an average equivalent weight of 82·1 ± 0·4.

* * *

The effect of sucrose and calcium ions on the determination of reducing substances in molasses. Sequestering of calcium ions. J. MENDLOVÁ. *Listy Cukr.*, 1960, **76**, 274–277.—Determination of the invert sugar content in model solution and final molasses shows that in the presence of sucrose and calcium ions, the most suitable method for invert sugar determination is the Lane-Eynon method, sequestering the calcium ions with an equivalent amount of EDTA (found by determining the calcium ions in the sugar solution by titration). Of the other methods tested, that of Ofner gave an error of about 3%, and the Schoorl and Luff-Schoorl methods may be applied up to 0·5% Ca ions, although sequestering of the Ca ions is not recommended. The greatest error was given by the Scales method (4·2%).

* * *

Raw value equivalent of commercial sugars. D. SUERTE. *Sugar News* (Philippines), 1960, **36**, 535–540.—Four methods of determining the raw sugar value of commercial sugars are described, i.e. the U.S. Treasury Department method, according to which 1·75% is added for each degree of pol from 96° upwards; the polarization ratio method, whereby the sugar pol is divided by 96°; the method of the International Sugar Council, which assumes a molasses of 50° pol adhering to the sugar; and the *s-j-m* formula of Deerr. The last two are in close agreement and are considered the most accurate. The International Sugar Council method is therefore recommended for Philippine manufacturers. The polarization ratio method is the least accurate, as it assumes that all the sucrose in the product is available, while the U.S. Treasury Department method assumes a molasses of 39° pol adhering to the sucrose crystals.

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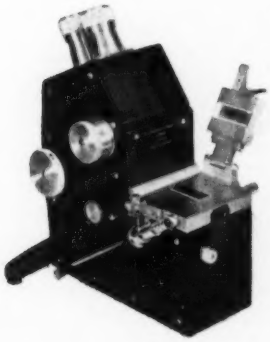

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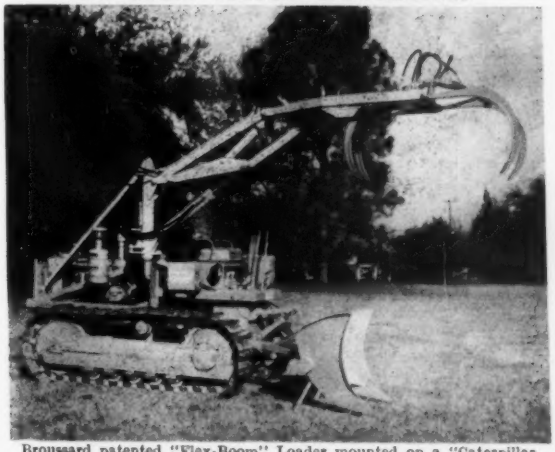

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BY-PRODUCTS

Insoluble materials of the sugar cane. E. A. VÁZQUEZ. *Bol. Ofic. A.T.A.C.*, 1960, **19,** 287–295.—The chemistry of the constituents of cane fibre and their separation are discussed with a number of references to the literature.

* * *

Production of yeast fodder in the sugar factory. K. ČIŽ. *Listy Cukr.*, 1960, **76,** 251–254.—Details are given of the scheme at Čakovice sugar factory for production of yeast fodder in which ammonium sulphate, superphosphate and *Saccharomyces cerevisiae* are added to the molasses, the product then mixed and further processed by adding to fodder. The economics are discussed. As a control, the electrical conductivity of the mash and during yeast enrichment of the fodder is continuously recorded. To make up for mineral deficiencies and reduce the acidity, milk-of-lime is added to the final product (25 kg milk-of-lime per 10 tons of fodder).

* * *

Mycological production of citric and oxalic acids from cane molasses. II. Effect of some enzyme inhibitors. III. Effects of some mixed substrates. I. R. SHIMI and S. NOUR EL DEIN. *J. Sci. Food Agric.*, 1960, **11,** 613–619; 619–622.

I. The behaviour of preformed mats of a strong and weak acid-producing strain of *Aspergillus niger* was studied when these were floated on sucrose, molasses and citric acid solutions containing various concentrations of sodium arsenite or monoiodoacetate, or 2,4-dinitrophenol (on carbohydrate solutions only). The α-keto acids which accumulated in the metabolism solutions containing arsenite were traced by paper chromatography of the 2,4-dinitrophenylhydrazones. It was found that in molasses and sucrose solutions the sugar is degraded mainly via the glycolytic route and a minor channel insensitive to iodoacetate; that the sugars in molasses are mainly catabolised through the tricarboxylic acid cycle (T.A.C.), yielding citric acid as a metabolic product. Formation of mycelial cell constituents is promoted in molasses probably by the nitrogenous compounds available for such a metabolism. Oxalic acid is formed in molasses and sucrose solutions through more than one route. Greater amounts of hydrazones were isolated from the treated molasses than from the sucrose solutions, indicating a higher rate of circulation of the T.A.C. in the former. The processes involved in citric and oxalic acids require energy-rich phosphate bonds.

II. The effects on *A. niger* fermentation of sucrose and molasses of various concentrations of ethanol, and sodium acetate and pyruvate were studied in the presence of optimum concentrations of ferrocyanide and phosphate. Such mixtures gave appreciably increased citric acid yields with traces of oxalic acid and the time of incubation could be reduced. The behaviour of two potent citric-acid-producing strains of *A. niger* on molasses with methanol added was also investigated. The results are discussed on the basis of well-known metabolic routes.

* * *

Developments in the extraction of sugar cane wax. J. POMINSKI and B. M. KOPACZ. *Brit. Chem. Eng.*, 1960, **5,** 860–862.—The composition and extraction of cane wax is discussed with 27 references to the literature. Details are given of a process in which the cane mud is slurried with heptane at 170°F during ½–2 hr and the mixture filtered. The mass velocities, i.e. lb of (solvent + wax) filtered per hr/sq.ft. of filter surface, were determined for a 2-in thick cake at a vacuum of 4-in Hg. A mass velocity of 5725 lb/hr/sq.ft. was obtained (2000 lb/hr/sq.ft. or more is considered satisfactory for commercial purposes) and an extraction efficiency of 85%. Diluting the muds with water decreased the extraction efficiency considerably and reduced the mass velocity to a value lower than 2000 lb/hr/sq.ft. The analysed crude wax revealed a hard wax content of 44·2%, 40% oil and 15·8% resins. A mild planetary mixing action is required to obtain high extraction efficiencies for U.S. muds, as opposed to the commercial process in Cuba, where extraction efficiencies of 70% are obtained.

* * *

A supplemental winter grazing crop for beef cattle in Florida Everglades. B. A. BOURNE, W. HUNDERTMARK and H. J. ANDREIS. *Sugar J.* (La.), 1960, **23,** (6), 20–24.—Tests are discussed, in which beef cattle were grazed on four cane varieties, during the period January–March 1960. A supplemental daily feed consisted of 4·5 lb of blackstrap molasses plus some frozen grass. It was found that the cattle showed distinct preference for certain varieties. No mowing was required after grazing and an excellent stubble crop resulted. Average weight gain was 10 lb.

* * *

Important developments and research related to animal feeds. L. G. JOYNER. *Sugar J.* (La.), 1960, **23,** (6), 29–32.—Research on molasses as fodder is discussed with a particular emphasis on the significance of ammoniation.

* * *

Chemicals for the food industry derived from sugar. B. R. B. MATHEWS. *Food Technol. in Australia*, 1960, **12,** 267, 269–270, 273, 275; through *S.I.A.*, 1960, **22,** Abs. 998.—A survey is given of fermentation products from molasses (alcohol, CO_2, citric acid, acetone, butanol), sorbitol and mannitol production by catalytic hydrogenation of invert sugar, the manufacture of sorbitol and sucrose fatty acid esters, and the preparation of ascorbic acid from sorbitol. The uses of these products are discussed. The products are being manufactured by the Colonial Sugar Refining Co. in Australia.

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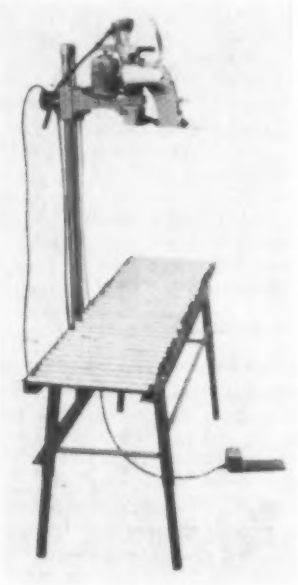

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Data sheet LR illustrates and provides information on the current range of Elcontrol level control units, probes and relays. They apply to conducting liquids and operate basically as a function of making or breaking the circuits as the level falls below or contacts the probe. Various units are included, e.g. intrinsically safe, high pressure, miniature, and heavy duty models.

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* * *

Liquid sugar carrier. Guy Motors Ltd., Park Lane, Wolverhampton.

The tanker illustrated is one of two supplied for transport of liquid sugar from Brown & Polson Ltd. of London to Quantock Preserving Co. Ltd. of Bridgwater, Somerset. The stainless steel tank is of 3000 gallons capacity and 3-inch reversible cargo pumps are provided, fitted with hand throttle controls.

Brazil Sugar Exports [1]

Destination	1958	1959	1960
	*Metric tons, tel quel**		
AMERICAS:			
Argentina	15,074	—	—
Bolivia	1,070	388	936
Chile	55,648	13,063	82,745
United States	—	10,537	103,423
Uruguay	56,140	80,666	55,976
Total Americas	127,932	104,654	243,080
EUROPE:			
Belgium	—	22,639	39,056
Finland	10,552	—	—
France	70,282	70,975	88,869
Ireland	—	29,940	—
Italy	68,007	6,080	—
Netherlands	35,895	8,598	2,149
Norway	—	—	10,297
Poland	—	—	10,262
Portugal	16,336	11,441	25,981
Spain	10,210	6,239	—
Sweden	8,577	—	—
United Kingdom	54,216	81,495	13,520
Total Europe	274,075	237,407	190,134
AFRICA:			
Egypt	10,426	—	—
Federation of Mali	—	1,206	10,287
Morocco	39,865	31,273	31,566
Sudan	27,072	9,586	—
Tunisia	—	17,449	—
Total Africa	77,363	59,514	41,853
ASIA:			
Ceylon	74,864	118,079	81,947
China (Mainland)	99,431	—	—
Israel	31,595	16,399	—
Japan	89,528	66,193	288,261
Jordan	—	3,574	—
Malaya	1,021	—	—
Vietnam	—	—	9,500
Total Asia	296,439	204,245	370,208
Other countries	—	61	—
GRAND TOTAL	775,809	605,881	854,775

[1] *I.S.C. Stat. Bull.*, 1961, **20**, (3), 15.

* Consists of high polarizing "crystal" sugars, refined and Demerara type sugars.

Mozambique sugar plans.—It is reported[2] that authority has been requested from the Portuguese Government for the establishment in the Manica and Sofala District of a sugar factory with a capacity to produce 60,000 tons of sugar annually.

* * *

Israel beet acreage rise[3].—Beet acreage in Israel is to be increased in 1961 by 65% to 58,000 dunams. The estimated yield from this area is some 270,000 tons compared with the 1960 figure of 170,000 tons from 35,000 dunams (about 22,000 acres).

* * *

Sudan sugar factory[4].—The foundation stone of the sugar factory at Guneid on the Blue Nile was laid on the 16th December 1960. An area of 5000 feddans (5190 acres) was to be under sugar by this year and this will be increased to 15,000 feddans in 1963 when the refinery reaches its full capacity of 60,000 tons of refined sugar per year.

BREVITIES

Beet trials in Alabama[5].—The Alabama State Agriculture Commissioner has asked the Auburn Experiment Station to grow sugar beets in the state experimentally with a view to future establishment of the industry there.

* * *

British Guiana record sugar crop[6].—The 1960 sugar crop closed at an all-time record of 334,441 tons late in December. This is the highest sugar production in the history of British Guiana, being 28,080 tons more than the previous record of 306,361 tons in 1958 and 50,016 tons more than in 1959.

* * *

Sugar expansion plans in Argentina[7].—The Government of the Province of Corrientes, Argentina, is inviting U.S. capital for establishment and operation of a plant in that immediate vicinity for the manufacture of sugar. As an inducement, the potential investor will be exempted from all taxes for a period of 10 years.

* * *

The late James Leslie Fairrie.—J. LESLIE FAIRRIE was a son of JAMES FAIRRIE who died in 1926. He and his brother GEOFFREY managed the business of Fairrie & Co. Ltd. after his father's death until the Company was acquired by Tate & Lyle Ltd. in 1929. He then forsook the technical side of the industry for the commercial and became a sugar broker, with close associations with Galban Lobo of Havana. During the War he applied himself to the problems concerning composition and packing of high-calorie foods for combat troops. In later years he employed his considerable skill as a mechanical engineer in designing packing machinery. He died suddenly on the 16th April 1961.

* * *

Colombia sugar situation[8].—Colombia recently signed the International Sugar Agreement, subject to ratification by Congress. Officials of the Ministry of Development and the Cia. Distribuidora de Azúcares state that, as a result of Colombia's entry into the International Sugar Agreement, exports of sugar will begin on a limited scale early this year. Several groups of European investors have already arrived in Colombia with proposals to establish mixed capital companies, in cooperation with local investors, to expand the cultivation of sugar and install large sugar mills. The U.S. Government, which has already authorized an initial purchase of 6000 tons of Colombian sugar, is expected to grant Colombia a permanent quota early this year. It has been suggested that the country could export 50,000 tons of sugar in 1961. A new bank, the Banco Azucarero, is to be established in Cali with an initial capital of 5 million pesos. The bank will grant credits to the sugar industry, particularly the sugar mills in the Cauca valley.

* * *

Cane sugar yield record claim[9].—A yield of 163·6 tons of 22-month old cane per acre, with a sucrose content of 13%, i.e. 21·27 tons of sugar per acre is claimed to be a world record by two brothers of Pongola, South Africa, who produced this yield on an experimental plot last season. The yield was attained by providing optimum soil and water conditions and supplying the plant food the crop needed at the right time. About 1 ton of rock phosphate was applied, partly broadcast and partly in the furrow at planting. Plant population was double the normal with rows three feet apart. Nitrogen and potash were supplied at short intervals, using about 2 tons of 15-0-15 per acre. No fertilizer could be applied during the last ten months of growth as it was impossible to penetrate the dense stand of cane. Cutting of the cane was postponed for several months, and it is believed that the sucrose content would have been much higher had it been possible to harvest earlier.

[2] *Overseas Review*, (Barclays D.C.O.), January 1961, 18.
[3] *ibid.*, 46.
[4] *ibid.*, 41.
[5] *Birmingham News*; through *U.S. Beet Sugar Industry Newsletter*, 1961, **2**, (1), 2.
[6] *Chronicle W. India Comm.*, 1961, **76**, 20.
[7] *Willett & Gray*, 1961, **85**, 14.
[8] *Fortnightly Review* (Bank of London & South America Ltd.), 1961, **26**, 89–90.
[9] *S. African Sugar J.*, 1961, **45**, 31.

BREVITIES

U.K. beet price, 1961/62.—Among the guaranteed farm prices announced in the U.K. Parliament in March, that for sugar beet in 1961/62 will be unchanged at 128*s* 0*d* per ton of 16·5% sugar content with a difference of 7*s* 6*d* per ton for each 1% over or under 16·5%.

* * *

Sugar museum.[1]—A sugar museum, perhaps the first in the world, is being set up in Recife, Pernambuco, Brazil. It is to be housed in a 2-storey building and will have a covered area of 1400 sq.m., an auditorium capable of holding 250 people, and a library which is intended to be as complete as possible. The museum will contain exhibits including maps, books, prints, etc. covering the Brazilian sugar industry as well as the world history of sugar.

* * *

Bulk sugar terminal in British Guiana.[2]—On February 1st the new bulk sugar terminal at Ruimveldt, operated by Demerara Sugar Terminals Ltd., was set into operation. The $7,750,000 (£1,600,000) terminal includes two tall central towers which control the intake and outflow of sugar from two low-lying stores, each of 20,000 tons capacity. The sugar is received at the terminal by road and river transport and is loaded directly into the holds of ocean-going ships at the rate of 500 tons per hour. The sugar stores stand on semi-buoyant rafts of prestressed concrete sunk into the earth as firm protection against the Demerara mud. Contractors for the construction work were Soil Mechanics Ltd., a subsidiary of John Mowlem & Co. Ltd., and the mechanical handling plant was installed by Simon Handling Engineers Ltd.

Stock Exchange Quotations

CLOSING MIDDLE

London Stocks (*at* 17*th April*, 1961)	
Anglo-Ceylon (5s)	14/–
Antigua Sugar Factory (£1)	11/3
Booker Bros. (10s)	30/6
British Sugar Corp. Ltd. (£1)	24/3
Caroni Ord. (2s)	3/10½
Caroni 6% Cum. Pref. (£1)	14/6
Distillers Co. Ltd. (10s units)	37/4½
Gledhow Chaka's Kraal (£1)	37/6
Hulett & Sons (£1)	50/–
Jamaica Sugar Estates Ltd. (5s units)	4/–
Leach's Argentine (10s units)	25/–
Manbré & Garton Ltd. (10s)	45/–*
Reynolds Bros. (£1)	33/–
St. Kitts (London) Ltd. (£1)	20/–
Ste. Madeleine (Ord.) (£1)	27/9
Sena Sugar Estates Ltd. (10s)	11/3
Tate & Lyle Ltd. (£1)	51/–
Tate & Lyle Investments Ltd. (5s)	15/1½
Trinidad Sugar (5s stock units)	44/6
United Molasses (10s stock units)	40/–
West Indies Sugar Co. Ltd. (£1)	17/6

*50% capitalization

CLOSING MIDDLE

New York Stocks (*at* 15*th April*, 1961)	$
American Crystal ($10)	44
Amer. Sugar Ref. Co. ($25)	33½
Central Aguirre ($5)	24¾
Cuban American ($10)	19⅜
Great Western Sugar Co.	32⅝
South P.R. Sugar Co.	18
United Fruit Co.	20⅞

St. Kitts 1959/60 sugar production[3].—Grinding of the 1959/60 crop ceased at the central factory on the 12th September up to which date 437,693 tons of cane were ground, making 50,179 tons of 96° sugar, an average of 8·72 tons of cane per ton of sugar. Some 38,150 tons of sugar have been exported, leaving 8226 tons available for shipment.

* * *

Sugar factory for North Vietnam.[4]—A new sugar factory was put into operation in the district of Viet Tri early in December 1960. The factory, the capacity of which is not yet known, processes sugar cane cultivated in the district of Viet Tri. Experts from Mainland China have been sent to advise the farmers in North Vietnam on the cultivation of sugar cane.

* * *

Indonesia sugar export ban[5].—Indonesia has banned all sugar exports. Sugar output in 1960 was down by 10–20% from last season and exports have been stopped to ensure that there will be enough sugar for home consumption.

* * *

Chile sugar production 1960[6].—Industria Azucarera Nacional (IANSA) produced a total of 70,000 tons of beet sugar at its plants in Los Angeles, Linares and Llanquihue in 1960. Total annual consumption in Chile is about 210,000 tons.

* * *

Argentina sugar factory.[7]—Ingenio San Javier, at present under construction at San Javier, Misiones, Argentina, is provided with an alcohol distillery, and is expected to be in production at the end of 1961 or beginning of 1962. Machinery for the factory has been acquired from Brazil.

* * *

Louisiana sugar crop, 1960.[8]—Sugar production in Louisiana amounted to 466,530 short tons, raw value, in 1960, the cane tonnage ground being approximately 6,000,000 tons equivalent to about 5,550,000 tons net cane after trash deductions. This tonnage came from 268,000 acres, the corresponding yields being 20·7 net tons per acre (20·3 in 1959) and 167 lb of sugar per acre (175 pounds in 1959).

* * *

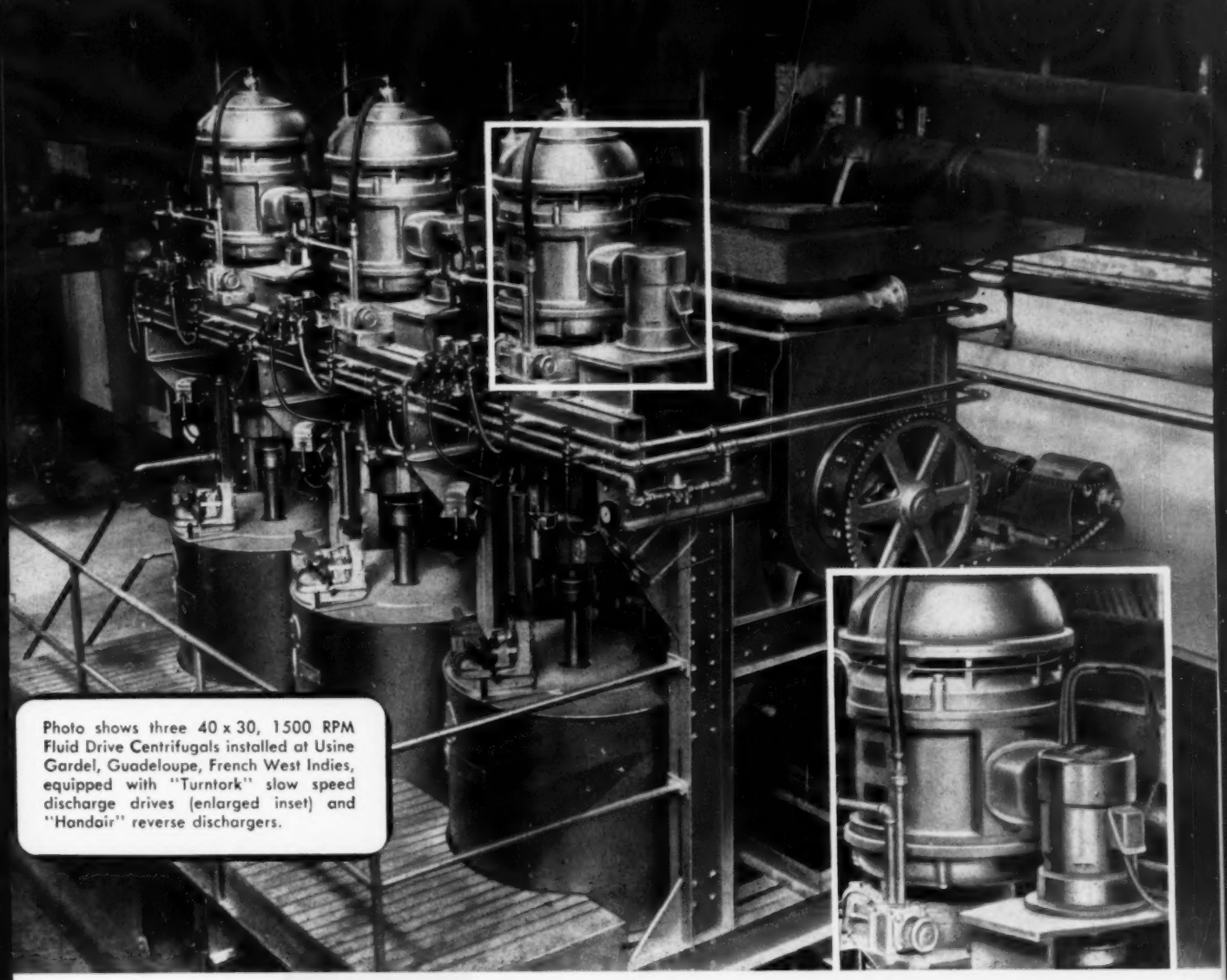
South African sugar crop, 1960/61.[9]—All mills in the Union of South Africa have now ceased operations and, subject to final checking and adjustment, final production is put at 994,363 short tons. Taking into consideration the estimated output of the two Swaziland factories, where work is still in progress, an overall figure is reached of 1,051,519 short tons equivalent to 938,856 long tons. In 1959/60 production amounted to 1,043,301 short tons.

* * *

American Sugar Refining Co. 1960 Report.—A remarkable feature of the report, if only to be expected, is the elimination of Cuban operations and investments from the financial statement, following the seizure of the Company's assets including Centrals Cunagua and Jaronú. This involves a special charge to earned surplus of no less than $14,875,000, representing the total book equity of the Cuban investments less applicable tax reductions. Expenditure for additions and improvements to plant and equipment in the U.S.A. amounted to $26 millions during 1960. Deliveries of refined sugar were the equivalent of 1,937,438 short tons. The new refinery in Boston began operations in the early autumn of 1960. The report is beautifully printed and an important feature is a section with colour photographs and an interesting account of the new refinery. It is hoped to publish a description of the refinery shortly in this Journal.

---

[1] *La Industria Argentina*, 1961, **66**, 61.
[2] *Chron. W. India Comm.*, 1961, **76**, 61.
[3] *Overseas Review* (Barclays D.C.O.), October 1960.
[4] F. O. Licht, *International Sugar Report*, 1961, **93**, (Supp. 1), 14.
[5] *IFAP News*, November 1960.
[6] *Fortnightly Review* (Bank of London & South America Ltd.), 1961, **26**, 76.
[7] *La Industria Argentina*, 1961, **66**, 64.
[8] *Sugar y Azúcar*, 1961, **56**, (3), 42.
[9] C. Czarnikow Ltd., *Sugar Review*, 1691, (503), 75.



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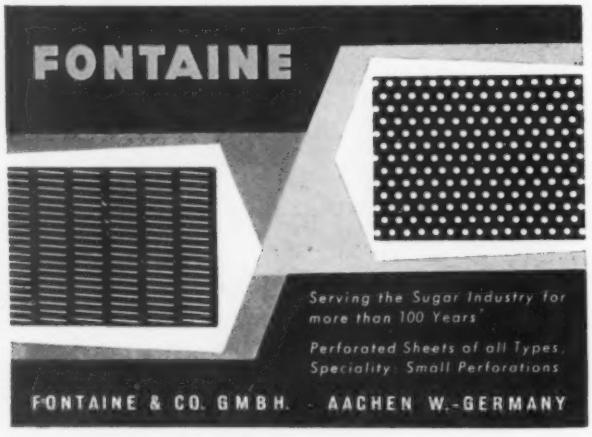
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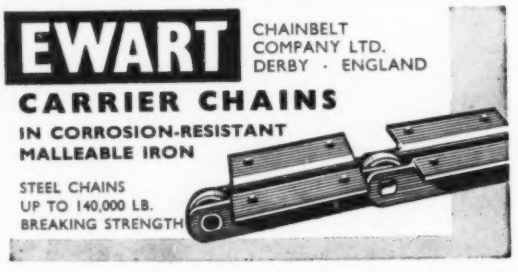

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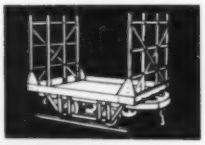

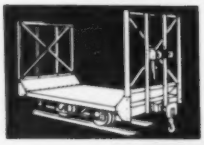

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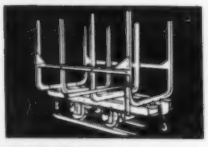

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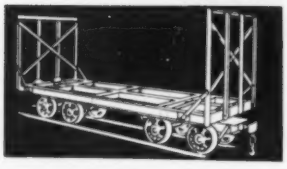

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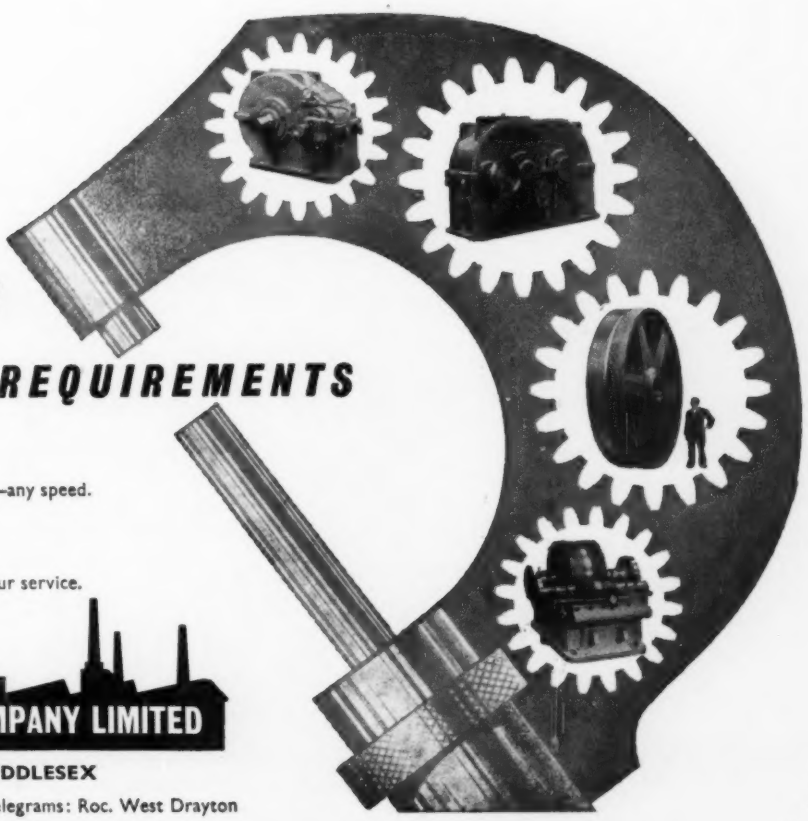

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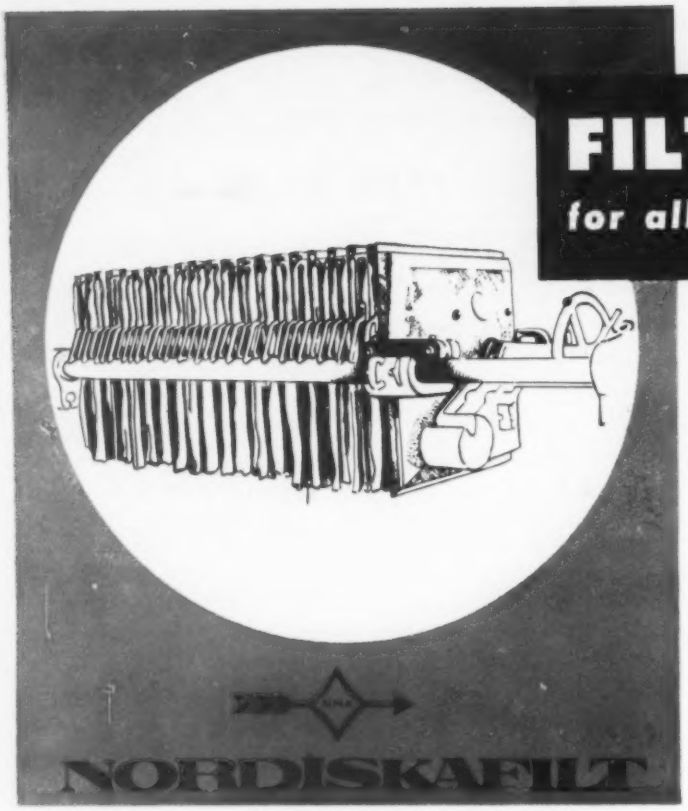

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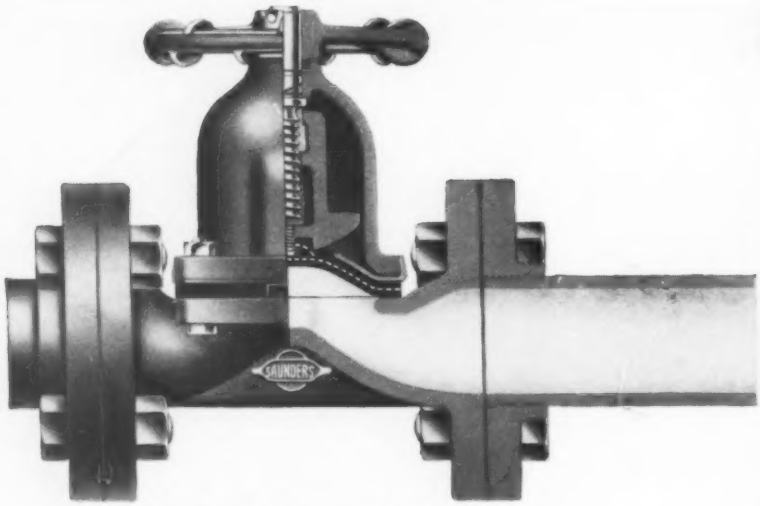

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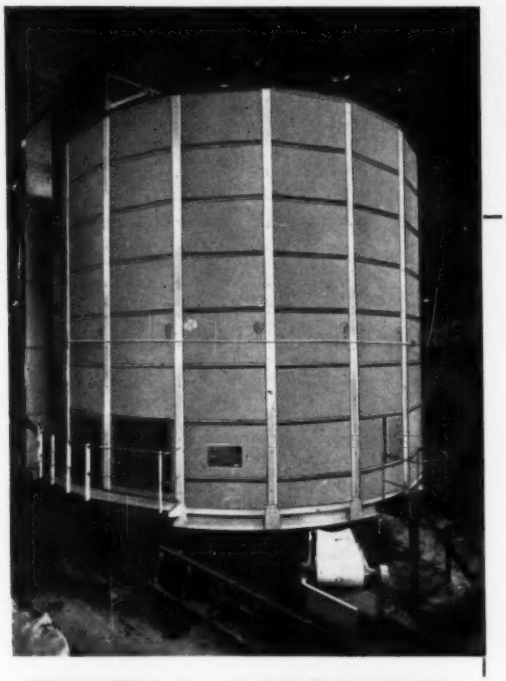

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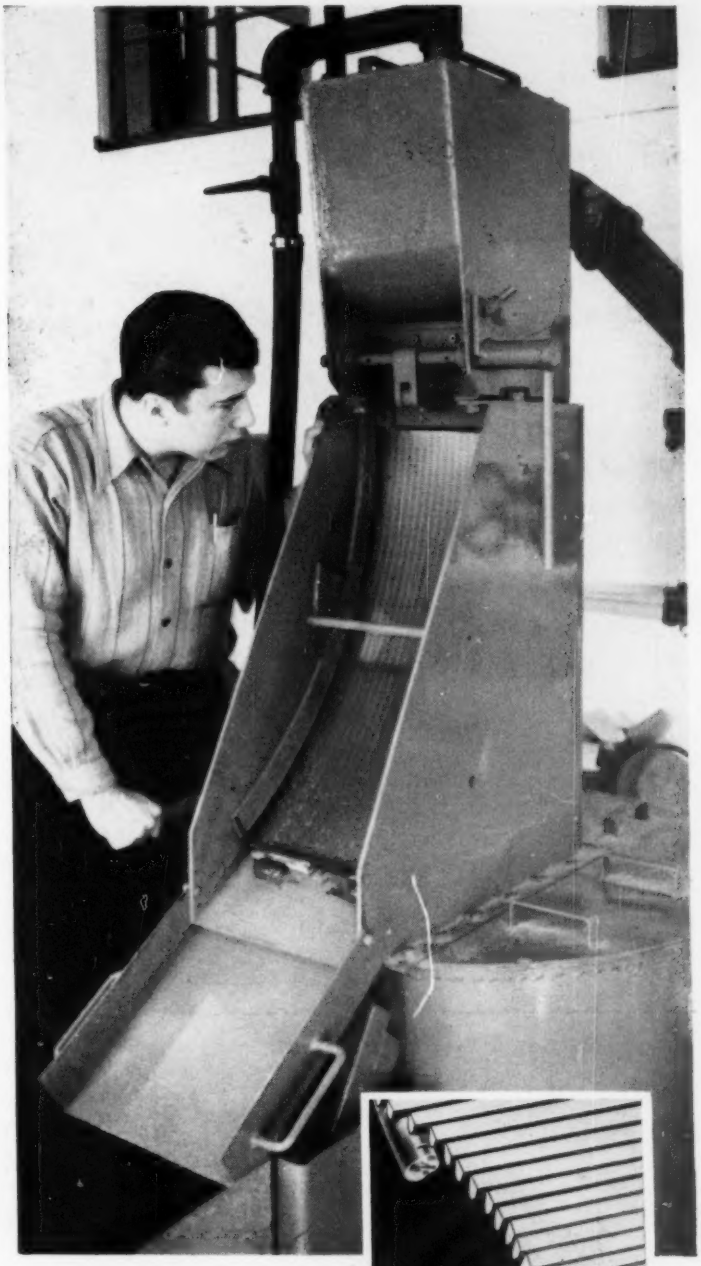
A NEW WAY TO SEPARATE FIBER FROM CANE JUICE...

The DORR-OLIVER DSM® SCREEN

Latest addition to Dorr-Oliver's line of sugar processing equipment is the DSM Screen. A radical departure from normal practice, the DSM offers many advantages over conventional screens. It consists of a stationary housing equipped with a concaved wedge bar type screen with provisions for introducing feed and withdrawing fiber and juice.

In operation, juice enters the feed box and is fed by gravity tangentially onto the upper surface of the screen. Flowing down the concave surface at right angles to the openings between the wedge bars, the juice passes through these apertures and is collected in the screen box. Fibers pass down the screen surface and are dewatered prior to discharge.

For further information on the DSM Screen for separating fiber from cane juice, write to Dorr-Oliver Incorporated, Stamford, Conn., U. S. A.



A DSM Screen installation showing simplicity of design and overall compactness.

Closeup showing detail of wedge bar design.

ADVANTAGES OF THE DORR-OLIVER DSM SCREEN

- Wedge bar design promotes high screening efficiency and essentially a non-blinding screen.
- The DSM is a compact unit which can be installed with a minimum of effort.
- Stationary design with no moving parts means low operating cost and minimum maintenance.

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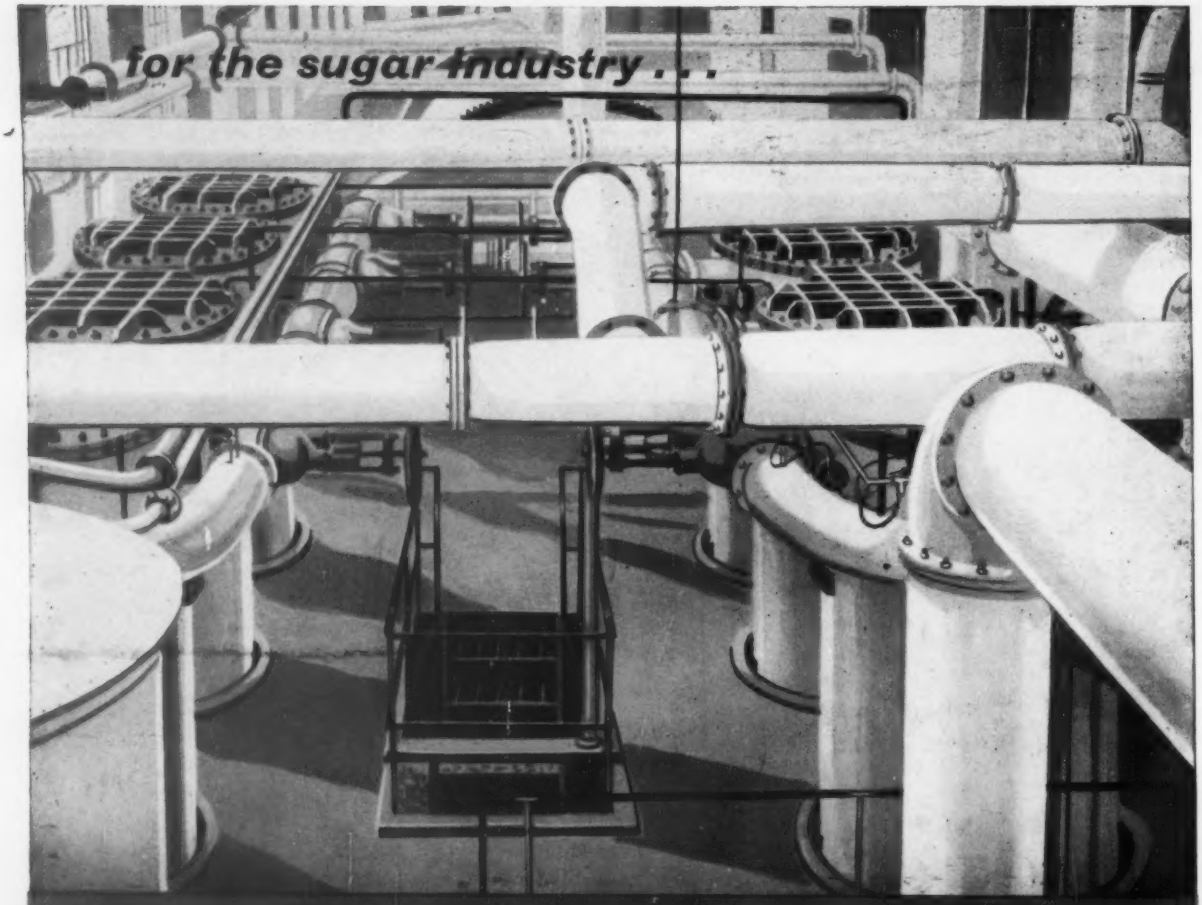
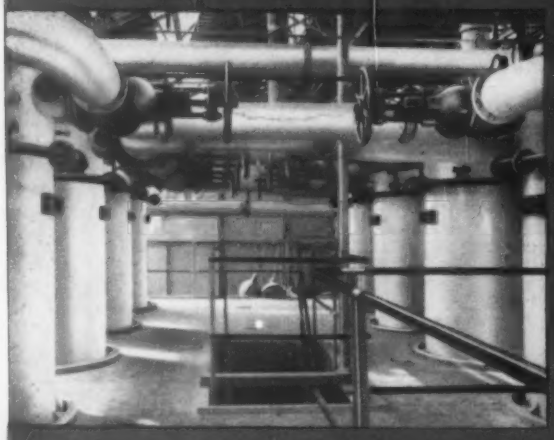


FLETCHER JUICE HEATERS



In these illustrations we show one mild steel JUICE HEATERS which has been supplied to the [illegible] Sugar Corporation's factory at Ely. Each heater has a heating surface of 320 sq. metres and will work in conjunction with the [illegible] R.T. Diffuser so far manufactured, which has a diameter of 6.75 metres. For some years now the Fletcher organisation has been supplying top quality machinery to both the beet and the cane industry at home and abroad.

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